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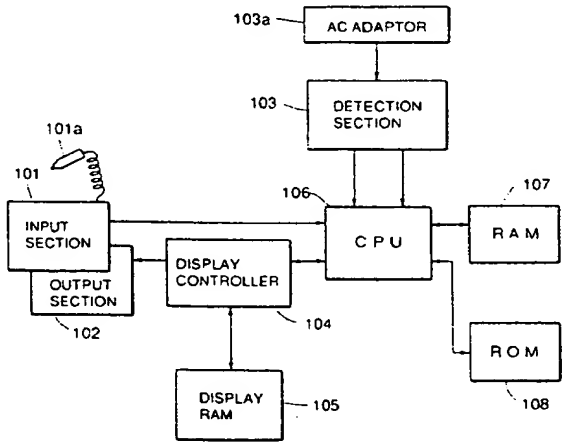
(54) Apparatus for controlling image display.

(57) An input-output integrated type electronic apparatus is arranged to enable the orientation of a displayed picture to be changed according to the orientation of the apparatus in a used state, whereby the facility with which the apparatus is used is improved. To change the display orientation, the content of a displayed picture is changed on the basis of a detected orientation of the apparatus.

FIG. 1



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BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to an input-output integrated type information processor capable of controlling the orientation in which a picture is displayed on a display screen.

Description of the Related Art

Fig. 18 is a block diagram of the hardware construction of a conventional input-output integrated type information processor. Data is input through an input section 101 by a special pen 101a. A picture is displayed on an output section 102 in accordance with the content of a display random access memory (RAM) 105 by a display controller 104.

A central processing unit (CPU) 106 controls the overall operation of the processor. A RAM 107 and a ROM 108 are connected to the CPU 106. The orientation in which a picture is displayed on the display screen is fixed. This processor is not designed to have means for changing the picture display orientation.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an electronic apparatus capable of changing the orientation of a displayed picture according to the orientation of the apparatus in a used state.

To achieve this object, according to one aspect of the invention, there is provided an electronic apparatus comprising input means for inputting information, display means including a display screen for displaying information, a casing for accommodating the input means and the display means, detection means for detecting orientation of the casing when the apparatus is used, and control means for changing the orientation of a picture displayed on the display screen on the basis of the detection made by the detection means.

According to another aspect of the invention, there is provided an electronic apparatus comprising input means for inputting information, display means including a display screen for displaying information, a casing for accommodating the input means and the display means, a base for receiving the casing, detection means for detecting the orientation of the casing relative to the base, and control means for changing the orientation of a picture displayed on the display screen on the basis of the detection made by the detection means.

According to still another aspect of the invention, there is provided an electronic apparatus comprising input means for inputting information, display means for displaying information, a casing for accommodating the input means and the display means, detection means for detecting the orientation of the casing when the apparatus is used, and control means for changing the orientation of a display content of the display means on the basis of the detection made by the detection means.

In accordance with another aspect of the present invention, an input-output type information processor includes input means for inputting information, display means including a display screen for displaying information, detection means for detecting the orientation of the apparatus in a used state and a control means for controlling the orientation in which a picture is displayed on the display screen of the apparatus are provided to enable the apparatus orientation in a used state to control the display orientation on the display screen without requiring a special operation by the user.

These and other objects, aspects, features and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of the hardware construction of a first embodiment of the present invention;

Fig. 2 is a circuit diagram of a detection section 103;

Fig. 3 is a diagram of an external appearance of a processor in accordance with the first embodiment;

Figs. 4(a) to 4(h) are diagrams of the relationship between the DC plug insertion direction and the display orientation;

Fig. 5 is a block diagram of the hardware construction of a second embodiment of the present invention;

Fig. 6 is a diagram of an external appearance of a processor in accordance with the second embodiment;

Fig. 7 is a circuit diagram of a detection section 501;

Fig. 8 is a diagram of an external appearance of a main unit of a processor in accordance with a third embodiment;

Fig. 9 is a schematic cross-sectional view of the main unit;

Fig. 10 is a bottom view of the main unit;

Fig. 11 is a first schematic cross-sectional view of a recess 1001 of the main unit;

Fig. 12 is a second schematic cross-sectional view of the recess 1001 of the main unit;

Fig. 13 is a diagram of an external appearance of a sub unit;
Fig. 14 is a schematic cross-sectional view of a hook portion 1303 of the sub unit;
Figs. 15(a) to 15(d) are diagrams of an example of an operation of combining/separating the main and sub units;
Fig. 16 is an external appearance view of another example of the operation of combining/separating the main and sub units;
Fig. 17 is a circuit diagram of a detection section in accordance with the third embodiment;
Fig. 18 is a block diagram of the hardware construction of a conventional input-output integrated type information processor;
Fig. 19 is a flowchart of a control process;
Fig. 20 is a diagram of a display screen;
Figs. 21(a) to 21(d) are diagrams of picture rotation;
Fig. 22 is a flowchart of a control process;
Fig. 23 is a diagram of an external appearance of a sub unit;
Fig. 24 is a diagram of a control process;
Fig. 25 is a diagram of a control process;
Fig. 26 is a block diagram of a main unit;
Fig. 27(a) is a cross-sectional view of a combined state of main and sub units;
Fig. 27(b) is a diagram of a switch of the main unit;
Fig. 28 is a block diagram of the sub unit; and
Fig. 29 is a flowchart of operating an optical communication plane.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described below with reference to the accompanying drawings.

Fig. 1 shows blocks of the hardware construction of an embodiment of the present invention. Each of elements shown in block outline in Fig. 1 as well as in Figs. 2, 5, 17, 18, 26 and 28, is well known per se, and a specific type of construction is not critical to carrying out the invention or to a disclosure of the best mode for carrying out the invention. An input section 101 is, for example, a pressure sensitive type tablet. Data is input by writing on the tablet with a special pen 101a.

An output section 102 is a display device, e.g., a liquid crystal display. The input section 101 and the output section 102 form an input-output integrated unit.

A detection section 103 detects the orientation of the information processor in a used state and sends a result of the detection to a CPU 106. An AC adaptor 103a extends from the detection section 103.

A display controller 104 displays information or images on the output section 102 in accordance with the content of a display RAM 105. The display controller 104 rewrites the display RAM 105 by a command from the CPU 106.

The display RAM 105 stores data for displaying through the output section 102.

The CPU 106 controls the overall operation of the information processor in accordance with control procedures stored in the memories 107 and 108.

The memory 107 is a RAM for storing display data and a control procedure, and the memory 108 is a control memory ROM in which a control procedure shown in Fig. 19 or 22, for example, is stored.

Fig. 2 is a detailed circuit diagram of the detection section 103. As shown in Fig. 2, there are four power supply channels having DC jacks 201 to 204, and a DC plug 206 is inserted into one of the DC jacks 201 to 204 to supply power. From each DC jack, a power supply line extends and a ground line and a picture orientation control signal line also extend.

An AC adaptor 205 is used to supply power from a home AC outlet and to convert AC power into DC power. DC power is supplied through the power supply line, the ground line and each picture orientation control signal line. A line 207 in Fig. 2 indicates a main body of the information processor.

Fig. 3 shows the outward appearance of the processor. The input pen 101a extends from a frame 301. The DC jacks 201 to 204 are provided in four side surfaces of the frame. (DC jacks 203 and 204 are not seen in Fig. 3.)

The operation of controlling the orientation in which a picture is displayed in accordance with this embodiment will be described below. Display contents displayed in a displayed picture are stored as bit map data in the display RAM 105. Fig. 4(a) shows an example of a display, and Fig. 4(b) shows the content of the display RAM 105 corresponding to this display example.

When the DC plug 206 is inserted into one of the DC jacks 201 to 204, electric power is supplied to the processor and one of picture orientation control signals a to d is sent to the CPU 106. The CPU 106 rewrites data in the display RAM 105 in accordance with a high level signal in picture orientation control signals a to d by a conversion formula shown below. However, CPU 106 does not convert data if the picture orientation control signal a is high.

(1) If the picture orientation control signal b is high,

$$\text{bit}(x, y) = \text{old bit}\left(\text{int}\left\{\frac{a}{b}\, y\right\}, \text{int}\left\{\frac{b}{a}\,(a - x)\right\}\right) \quad ⓐ$$

(2) If the picture orientation control signal c is high,

$$\text{bit}(x, y) = \text{old bit}(\text{int}\{a - x\}, \text{int}\{\tfrac{b}{a}(b - 7)\}) \quad ⓑ$$

(3) If the picture orientation control signal d is high,

$$\text{bit}(x, y) = \text{old bit}(\text{int}\{\tfrac{a}{b}(b - y)\}, \text{int}\{\tfrac{b}{a}x\}) \quad ⓒ$$

In these equations, a and b represent picture sizes, bit (x, y) represents data of $(x - \text{int}\{\frac{x}{8} \times 8)$ at address $(\frac{a}{8}y + \text{int}\{\frac{x}{8}\})$ in the display RAM 105. Also, $\text{int}\{\frac{a}{b}y\}$ represents an integer part of the value of $\frac{a}{b}y$.

Fig. 4(c) shows the state of the display RAM 105 after rewriting of the content thereof shown in Fig. 4(b).

The display controller 104 displays converted data in the display RAM 105 through the output section 102 to change the orientation in which a picture is displayed. Fig. 4(d) shows a picture displayed in accordance with the content of the display RAM 105 shown in Fig. 4(c) . Figs. 4(g) and g-(h) schematically show pictures in a case where the orientation in which the picture is displayed as shown in Fig. 4(a) is converted. Figs. 4(e) and 4(e and 4(f) are schematic diagrams corresponding to Figs. 4(a) and 4(c). As is apparent from Figs. 4(e) to 4(h), an operator using the processor can select an optimal picture display orientation in any situation by inserting the DC plug 206 into the DC jack at a position such that the AC adaptor 205 does not interfere with an input operation, i.e., the DC jack at the top of the processor as viewed by the operator.

Fig. 17 shows an example of a detection circuit of a third embodiment for detecting the orientation in which the processor is used. The circuit has pull-down resistors 1701 and 1702.

If the main unit is combined with a sub unit in a position such that a longitudinal axis of the main unit extends perpendicularly to a direction in which the operator faces the main unit (hereinafter referred to as "widthwise position") or in another position such that the longitudinal axis extends parallel to this direction (hereinafter referred to as "longitudinal position"), one of two electrodes 1201a and 1201b is electrically connected. The operation of controlling the orientation in which a picture is displayed by using picture orientation control signals is performed in the same manner as in the first and second embodiments.

The main unit and the sub unit are separately formed in accordance with the third embodiment. In such a case, when the main unit is used by being combined with the sub unit, a user can select the picture display orientation without being conscious of the selection.

Needless to say, the same effect can also be attained in a case where the user uses the main unit while the main unit is separated from the sub unit, if the first or second embodiment is practiced by being combined with the third embodiment.

Fig. 19 shows a flowchart of a picture display orientation changing process executed by the CPU as described above. In step 1901, the orientation of the processor in a used state is detected according to one of picture orientation control signals a to d set to high level. In step 1902, data in the display RAM 105 is transferred to the CPU 106. In step 1903, the data conversion method corresponding to the orientation of the processor in use detected in step 1901 is selected. If signal b is high, the data is converted in accordance with the equation ⓐ in step 1904. If signal c is high, the data is converted in accordance with the equation ⓑ in step 1905. If signal d is high, the data is converted in accordance with the equation ⓒ in step 1906. If signal a is high, the data is not converted. Next, in step 1907, the converted data is transferred to the display RAM 105 and, in step 1908, the display controller 104 outputs the data in the display RAM 105, thereby changing the orientation in which the picture is displayed.

In the above-described embodiment, a signal indicating the state of connection between a plurality of DC jacks and a plurality of DC plugs is used as means for detecting the orientation of the processor in a used state.

Alternatively, an orientation detection means using an input pen may be formed.

Fig. 5 shows blocks of the hardware construction of an embodiment of the present invention. A block 501 represents a detection section for detecting the orientation of a processor in a used state.

Fig. 6 shows the outward appearance of the processor in accordance with this embodiment. The processor has a frame 601 having four side surfaces. Connectors 602 to 605 in which a cord of an input pen 101a is inserted are respectively mounted in the side surfaces of the frame 601. (Connectors 604 and 605 are not illustrated in Fig. 6.) Each of the connectors 602 to 605 forms a depressed type switch which is depressed when the cord of the pen 101a is inserted.

Fig. 7 is a circuit diagram of an example of the detection section 501. Depressed switches 701 to 704 are arranged in correspondence with the connectors 602 to 605 along with pull-down resistors 705 to 708.

If the pen 101a is inserted into one of the connectors 602 to 605, the corresponding one of the depressed switches 701 to 704 is depressed and the corresponding one of picture orientation

controls signals a to d is sent to the CPU 106. The CPU 106 determines the display orientation from the received picture orientation control signal and converts data in the display RAM 105. In the above-described embodiment, data conversion is effected by changing the ratio of the longitudinal and widthwise sizes. In this embodiment, however, data conversion may be effected by changing display areas. Fig. 20 shows the relationship between a whole picture area 2001 and a display area 1002. The CPU 106 displays a picture by transferring data of the display area 2002 to the display RAM 105 through the display controller 104. That is, the displayed picture is changed by changing the display area or the order of transfer of data in the display area.

Fig. 22 shows a flowchart of another picture display orientation changing process in accordance with this embodiment. In step 2201, a display area is selected from the whole picture area shown in Fig. 20 to display a picture such as that shown in Fig. 21(a), and corresponding data is transferred to the CPU 106. In steps 2202 and 2203, a display area is selected to display a picture such as that shown in Fig. 21(b), and corresponding data is transferred to the CPU 106 to be converted. Similarly, in steps 2204 and 2205, and in steps 2206 and 2207, display areas are selected to display pictures such as those shown in Fig. 21(c) and 21-(d), respectively.

In the above-described embodiment, the means for detecting the orientation of the processor in a used state cannot be used when a battery or the like is used as a power source for the processor, since the detection means is based on the detection of the state of connection between DC jacks and DC plugs. In contrast, the processor of this embodiment is advantageous in that it is possible to detect the orientation of the processor in a used state and to control the picture display orientation even in use in which much importance is attached to the portability or a feature of the input-output integrated type, that is, when a home power supply is not used.

In the above-described first and second embodiments, the orientation of an input-output integrated type information processor is detected from the state of connection between the information processor and a cord. However, the orientation of this type of processor may be detected from the state of connection between a main unit and a sub of the processor by arranging the units in such a manner that the main unit is formed of a digitizer, a liquid crystal display, a CPU, a battery, backup memory, a hard disk and other components, while the sub unit is formed of a floppy disk drive, an I/O port such as an RS232, a network interface and other components, and that the main unit and the sub unit can be attached and detached (combined and separated) in a plurality of directions.

The construction of the main unit of a processor arranged in this manner will be described below.

Fig. 8 is a perspective view of an appearance of the main unit. The main unit has a casing having a generally rectangular external configuration. The casing is formed of an upper casing member 801, a middle casing member 802 and a lower casing member 803 each made of a resin. A generally rectangular opening is formed in a central portion of the upper casing member 801, and a digitizer 804 having an input surface is provided at the opening. A liquid crystal display (LCD) is provided under the digitizer 804. A holder 806 for an input pen 805 described later, a main switch 807, a knob 808 for adjusting the contrast of the LCD, an illustrated IC card connector and DC jack are provided on side portions of the middle casing member 802. Also, guide portions 1601a to 1601d in the form of elongated holes or recesses (Fig. 16) forming part of a means for combining the main and sub units are provided in two places in a side surface portion of the middle casing member 802 corresponding to the remote-most side as shown in Fig. 8 and in two places in an adjacent left side surface portion. A connector for connecting the input pen 805 is provided in the vicinity of the center of a right side surface portion. In this embodiment, this connector is covered with the holder 806 and cannot be seen in the external appearance. The input pen 805 and this connector are connected by a cord 809, which can be wound in a gap between a main unit side surface portion and the holder 806.

Fig. 9 is a schematic cross-sectional view (along the line I - I) of the main unit. Fig. 10 is a bottom view of the main unit. An LCD 901 and the digitizer 804 are fixed in a superposed state in the middle casing member 802. A printed circuit board 902 on which a CPU, memories, an LCD controller, a digitizer controller, a power supply circuit and other components are mounted is fixed below the LCD 901. The upper, middle and lower casing members 801, 802, and 803 are fixed to each other by screws or elastic hooks (snap-action fixing means). Further, two recesses 1001 and 1002 and a plurality of hemispherical projections 903a to 903d forming a part of the combining means are provided on a bottom surface of the main unit formed by the lower casing member 803. Also, a plurality of optical communication windows 1003a to 1003d arranged along the longitudinal axis, channels 1004a to 1004d for receiving the cord 809 pressed thereinto are formed in the bottom surface. The height of the projections 903a to 903d is smaller than that of rubber feet 1005a to 1005d.

Fig. 11 is a first schematic cross-sectional view (along the line II - II) of the recess 1001 of the main unit. An opening 1001a or 1002a is formed in a portion of one of four side surfaces forming each of the two recesses 1001 and 1002, and a plate spring 1101a or 1101b is provided in the opening 1001a or 1002a. Fig. 12 is a second schematic cross-sectional view (along the line III - III) of the recess 1001. Electrodes formed of two electrode pins 1201a and 1202b are provided in the opening 1001a. The recess 1002 is formed in such a manner that the recess 1001 is rotated clockwise by 90°.

The construction of the sub unit will be described below.

Fig. 13 is a perspective view of the outward appearance of the sub unit. The sub unit has a casing having an external configuration generally L-shaped as viewed from the left or right side. The casing is formed of an upper casing member 1301 and a lower casing member 1302 each made of a resin in such a manner that an elongated generally rectangular projecting portion 1301a is formed on an upper surface of a generally rectangular box at one side of the same. The width of the sub unit is approximately equal to the width of the main unit in the direction perpendicular to the longitudinal axis. A hook portion 1303 and an engagement knob 1304 forming part of a combining means are provided on an upper surface 1301b of the upper casing member 1301 (apart from an upper surface of the projection 1301a). A plurality of windows 1305a to 1305g for an optical communication unit are also formed in the upper surface 1301b in two rows extending along the pairs of opposite sides of the casing and intersecting perpendicularly with each other. The engagement knob 1304 is urged upward by an unillustrated spring and can move until its upper surface becomes approximately flush with the upper surface 1301b when a predetermined force is applied to the engagement knob 1304. On the upper surface of the projecting portion 1301a, a release button 1306 forming part of a means for separating the main and the sub units, and a plurality of light emitting diodes (LED) 1307a and 1307b for indicating the states of a power supply and a floppy disk drive or the like are provided. When the release button 1306 is manually depressed, the engagement knob 1304 is moved downward by an unillustrated incorporated rotary/slide mechanism. Guide pins 1308a and 1308b are provided at left and right positions on an inner surface of the projecting portion 1301a. An operating pin 1309 for operating a combined state detection switch described later is provided in the vicinity of one of the pair of guide pins 1308a. A port of a floppy disk drive 1310 is formed in one of the L-shaped side surface of the sub unit, while an unillustrated I/O port, a network interface, a keyboard connector and a DC jack or the like are provided at the other L-shaped side surface.

Fig. 14 is a schematic cross-sectional view (along the line IV - IV) of the hook portion 1303 of the sub unit. A printed circuit board 1401 on which a CPU, a memory, optical communication means and other components are mounted is fixed in the upper casing member 1301. Electrodes having a pair of electrode pins 1402a and 1402b urged in an axial direction by a spring are disposed inside the hook portion 1303.

Means for combining and separating the main and sub units will be described below in detail. The combining operation and the combining means will first be described.

Figs. 15(a) to 15(d) are external appearance perspective views for explaining the combining and separating operations in a case where the main unit is used in the longitudinal position. The positional relationship between the main and sub units and the state of the same when the operation of combining the main and sub units is completed as shown in Fig. 15(d) will be described first. When the main and sub units are combined completely, the sub unit is positioned under the main unit and at a position remote from the operator. Main portions of the side surfaces of the main and sub units facing in the widthwise direction are generally flush with each other. A predetermined gap is formed between the side surface of the main unit remote from the operator and the inner side surface of the projecting portion 1301a of the sub unit. At this time, the guide pins 1308a and 1308b of the sub unit are respectively inserted in the two guide portions 1601a and 1601b in the side surface of the main unit remote from the operator. Also, the hook portion 1303 of the sub unit is positioned in one of the recesses in the bottom surface of the main unit, i.e., the recess 1001, and a part of the hook portion 1301 is inserted in the opening 1001a. Also, some of the projections 903a to 903d on the bottom surface of the main unit contact the upper surface 1301b of the upper casing member 1301. In this state, the main and sub units are combined with each other with, if any, a very small play in the vertical direction (the direction of thickness). Also, in the combined state of the main and sub units, only a very small play can occur between the main and sub units in a direction parallel to the direction in which the operator faces the main unit (the longitudinal direction of the main unit) because of the cooperation of bottom surfaces of the guide portions 1601a and 1601b and extreme ends of the guide pins 1308a and 1308b and by the cooperation of an inner side surface of the recess 1001 in the vicinity of the opening 1001a and a side surface of the hook portion 1303 on the projecting

portion 1301a side. Further, a surface (not shown) in the opening 1001a in the recess 1001 of the bottom surface of the main unit abuts against an extreme end of the hook portion 1303, and one of rounded side surfaces of the guide portion 1601a and a side surface of the guide pin 1308a abut against each other. Also, the engagement knob 1304 of the sub unit is positioned in the recess 1001 in the bottom surface of the main unit with a predetermined gap formed between a right side surface of the engagement knob 1304 and a right side surface of the recess 1001. Therefore, only a very small play can occur between the main and sub unit in the direction perpendicular to the longitudinal axis of the main unit. Further, in the combined state, the operating pin 1309 of the sub unit is pressed into the body of the unit by the side surface of the main unit remote from the operator to operate the combined state detection switch. Also, the positions of the optical communication windows 1003a to 1003d and 1305a to 1305d of the main and sub units forming rows in the direction along the longitudinal axis coincide generally with each other. Further, the electrodes 1201a and 1201b on the main unit and the electrodes 1402a and 1402b on the sub unit are electrically connected by being brought into contact with each other at a predetermined spring pressure.

The combining operation will now be described. First, the main unit is placed on the upper surface 1301b of the sub unit as shown in Fig. 15-(a). At this time, the main and sub units are set in a positional relationship such as to be shifted from each other in the direction perpendicular to the longitudinal axis of the main unit, that is, the right side surface of the sub unit is positioned at a predetermined distance to the right from the right side surface of the main unit. Also, the side surface of the main body remote from the operator and the inner side surface of the projecting portion 1301a of the sub unit are at a predetermined distance from each other. Naturally, the guide pins 1308a and 1308b are not in the state of being inserted in the guide portions 1601a and 1601b. At this time, the hook portion 1303 of the sub unit is positioned in the recess 1001 in the bottom surface of the main unit. Then, the main and sub units are relatively moved until the side surface of the main unit remote from the operator and the inner side surface of the projecting portion 1301 of the sub unit are brought into contact with each other. Simultaneously, the guide pins 1308a and 1308b are inserted into the guide portions 1601a and 1601b. Also, the operating pin 1309 is positioned at the guide portion 1601a and in a free state such that the combined state detection switch is not operated. Next, the main and sub units are relatively moved to the left and right. By this movement, the unillustrated surface in the opening 1001a in the recess 1001 of the bottom surface of the main unit and the extreme end of the hook portion 1303 of the sub unit are brought into contact with each other, and one of the rounded side surfaces of the guide portion 1601a are also brought into contact with each other, thereby positioning the main and sub unit in the direction perpendicular to the longitudinal axis of the main unit. By this operation, the hook portion 1303 is also inserted into the opening 1001a of the recess 1001. Further, by this operation, the engagement knob is temporarily moved downward by the bottom surface of the main unit and becomes free at a position in the recess 1001 to move upward by the urging force.

Next, the separating operation will be described. The engagement knob 1304 is moved downward by depressing the release button 1306 on the projecting portion 1301a of the sub unit. In this state, the main and sub units are relatively moved to the left and right, i.e., in directions opposite to the directions at the time of combining. Thereafter, the main and sub units are moved along the longitudinal direction of the main unit so that the guide pins 1308a and 1308b are disengaged from the guide portions 1601a and 1601b.

The combining/separating operation in a case where the main unit is used in the widthwise position will be described below. In this case, the main unit is used after being positioned in such a manner that it is rotated clockwise by 90° from the longitudinal position. Fig. 16 shows a state of the main and sub units completely combined after being positioned in this manner. The left side surface of the main unit in the longitudinal position corresponds to the side surface of the main unit remote from the operator in the widthwise position. When the combining operation is completed, the side surface of the main unit remote from the operator in the longitudinal position (the right side surface in the widthwise position) is generally flush with the right side surface of the sub unit.

At the time of combining for setting the widthwise position, the positional relationship between the guide portions 1601a and 1601b and the guide pins 1308a and 1308b, the positional relationship between the recess 1002 of the main unit and the hook portion 1303 of the sub unit, the state and the combining operation of these parts are the same as those in the case of combining for setting the longitudinal position. That is, the arrangement is such that the positions of the guide portions 1601a and 1601b, the recess 1001 and other parts of the main unit functioning in the longitudinal state as viewed from a vertex at a right corner of the main unit remote from the operator when the longitudinal position is selected are the same as the positions of the guide portions 1601c and 1601d, the recess

1002 and other parts functioning in the widthwise state as viewed from a vertex at a right corner of the main unit remote from the operator when the widthwise position is selected. Also, when the main unit is combined with the sub unit in the widthwise position, the optical communication windows 1003a to 1003d in the bottom surface of the main unit coincide generally with the windows 1305d to 1305g of the sub unit forming a row in the widthwise direction of the main unit. The rows of windows 1305a to 1305g intersecting each other at right angles are arranged so that the point of this intersection coincides with the point of intersection of two straight lines which intersect, at 45°, the side of the main unit having vertexes at the right and left corners of the main unit in the longitudinal position. It is thereby possible to use the window 1305d at the point of intersection in common with respect to the longitudinal and widthwise positions. When the main and sub units in the combined state is placed on a horizontal plane, for example, on a desk, the input surface has a predetermined angle as in the case of the combined state in the longitudinal position. Also, the separating operation when the widthwise position is selected can be completed by pressing the release button 1306 of the sub unit to move the engagement knob 1304 downward to allow the predetermined movement, as in the case of the operation when the longitudinal position is selected.

In the above-described combining/separating operation, the projecting portion 1301a of the sub unit can be used as a suitable reference mark. Also, the operator can hold the projecting portion 1301a to relatively move the units. Thus, the combining/separating operation can be performed very easily.

The overall electrical construction of this information processor will be described below with reference to Fig. 26. A CPU 10 is a 32-bit CPU, such a i80386SL, a product from Intel Corp., which executes programs for an operation I/O control and the like. A peripheral chip set 11 is used in combination with the CPU 10 to control necessary peripheral I/O processing (serial communication, parallel communication, real time clock, timer, interruption control, DRAM control and the like). A memory section 12 includes a main memory (DRAM: 8MB), a cache (64 kB), and a boot ROM. The main memory is backed up in a suspended state and stores a control process executed by the CPU. A hard disk drive (HDD) has a 1.8 inch or 1.3 inch hard disk, and has a capacity of 20 to 80 MB for storing operating system data, application software data, user data and the like.

This embodiment is arranged as a pen computer to which data is input by operating a pen 15 on a digitizer 16 in the same manner as writing on paper. A locus of writing or an inputting result is displayed on a liquid crystal display (LCD) 19. The LCD 19 and the digitizer 16 are arranged by being superposed so that an input position and an output position can be recognized as equal to each other. The input precision of the digitizer 16 is not higher than the precision determined by dots of the LCD, e.g., 0.1 mm. A digitizer control section 14 controls the digitizer 16 and has an internal construction (not shown) formed of a CPU, a ROM, a RAM, a driver and other components. An LCD controller 17 successively accesses display data stored in a VRAM 18, transfers the data to the LCD 19 while taking gradations into account, and performs a bus control such that accessing to the VRAM 10 and accessing the data transferred to the LCD are preventing from falling on each other. Logical operations AND, OR, EXOR and the like of the content of the VRAM 18 with determined data may be performed (for example, by a VGA controller). A back light 21 is a light emitting device disposed at the back of the LCD 19 to enable the LCD 10 to be observed even in a room or a dark place. The back light may be of an electroluminescent type or a cold cathode lamp type. A back light inverter 20 is a driver for driving the light emitting device.

A card interface 23 is an interface capable of receiving memory cards, such as a ROM card for adding an application program or data, a ROM card for use as an extended memory or for a backup operation, and a flash card for a backup operation or adding data, and I/O cards, such as a facsimile data modem card for sending/receiving data through a telephone line and a local area network (LAN) card for connection to a network. The interface standard using a 68 pin type determined by JEIDA/PCMCIA is becoming dominant. A card controller 22 performs control processing (address change processing or the like) for writing or reading data from the CPU on a card or reading.

A communication controller 24 is a controller for data communication in the SDLC form. In a channel A, data for devices such as a keyboard, a floppy disk drive or a centro pertaining to nodes of the sub unit is transmitted or received. In a channel B, data is directly exchanged through the sub unit by a kind of network communication such as Local Talk. For communication through each of the channels A and B, a light driver/receiver 25 or 26 and a set of light emitting diodes (LED) and a photodiode (PD) 27 or 28 are provided. A DC-DC converter 32 converts a power supply voltage supplied from one of a battery 33, an AC adaptor jack 34 and connection electrodes 35 for connection with the sub unit into voltages used in the main unit (+5 V for logical circuit, + 12 V for back light, -24 V for LCD).

Figs. 27(a) and 27(b) show a combined state detecting means. Fig. 27(a) is a cross-sectional view when the main and sub units are combined. The CPU 10 is informed of whether the main and sub units are combined or separate by being supplied with a signal indicating that a hook portion 603 of the sub unit is pressing a switch of the main unit through a circuit such as that shown in Fig. 27-(b). It is informed by interruption INT and can recognize the state from an I/O (not shown).

When the main and sub units are combined with each other, the LEDs and PDs for optical communication through channels A and B face corresponding elements of the sub units, thereby enabling non-contact communication. Also, electrodes 119 of the sub unit and the electrodes 35 of the main unit are brought into contact with each other for power supply.

Fig. 28 shows an electrical block diagram of the sub unit.

A CPU 100, peripheral chips 101 and a memory 102 serve to perform an overall electrical control. The sub unit contains devices, which are not incorporated in the main unit, i.e., a floppy disk drive (FDD), a keyboard, a centro interface and a network interface.

A floppy controller 103 controls a 3.5 inch floppy drive unit 104. A keyboard controller 105 for controlling the keyboard informs the CPU 100 of depressed keys on the keyboard. Data of the FDD and the keyboard is sent to the main unit through a communication controller 110. A centro driver 108 is an interface for outputting data from the CPU 100 to a printer or the like. The communication controller 110, light drivers/receivers 111 and 112, and sets of LEDs and PDs 113 and 114 are the same as those in the main unit.

A network interface 115 serves for conversion to a suitable voltage and a suitable impedance when the unit is connected to a network. In this embodiment, a signal in the main unit channel B is directly sent to a network.

A DC-DC converter 117 is a power source for the sub unit and is supplied with power through an AC adaptor shutter 120. A combined state detecting means 118, which is is the same as that described above, closes a switch 121 when the combined state is detected, and supplies a signal to the electrode 119 connected to the main unit in the combined state.

Fig. 29 is a flowchart relating to turning on/off an optical communication plane in accordance with this embodiment. When the main and sub units are combined, the CPU 10 is interrupted by an interrupt signal. In an interruption routine, the state of the combined state detection switch is confirmed again in step 200. If the combined state is confirmed, the optical communication plane is turned on in step 201. That is, a fourth bit of a power supply plane I/O 30 is set to high level to turn on a switch 31. In step 202, passage of N msec is awaited before the power supply is stabilized. In step 203, the communication controller is initialized. In step 204, a communication flag is turned on, thereby completing the interruption routine. For ordinary communication, selecting is performed which is called for a certain time period only when the communication flag is on, and which is called according to polling or a necessary phase. First, in step ① 205, the combined state detection switch is confirmed. If the combined state is confirmed, a communication routine is started in step 206. If the combined state is not confirmed, it is determined that the main and sub units are separated, and parameters necessary for communication and other data are backed up in step 207. The optical communication plane is turned off in step 208, and the communication flag is turned off in step 209, thereby terminating the process.

The process does not proceed into the communication routine unless the communication flag is turned on in the combined state interruption routine.

When the power source is turned on, the confirmation of the combined state detection switch is effected during power supply initialization. If the combined state is thereby confirmed, the optical communication plane is turned on, the communication controller is initialized and the communication flag is turned on.

In the third embodiment, the detection of orientation of the processor in a used state is effected on the main unit side. Alternatively, it may be effected on the sub unit side in accordance with another embodiment. Fig. 23 shows an external appearance of a sub unit in accordance with this embodiment. Holes 1305h to 1305m are optical communication unit windows similar to the windows 1305a to 1305g. A process of changing the displayed picture orientation in accordance with this embodiment will be described with reference to Figs. 24 and 25. Fig. 24 is a flowchart of the main unit. In step 2401, an orientation detection packet signal is sent to the sub unit through optical communication windows. Transmission of this packet signal is continued until an orientation control packet signal is sent from the sub unit in step 2402. In step 2403, the orientation control packet signal is analyzed to detect the orientation of the processor in a used state. Steps 1902 through 1908 show a picture display orientation changing process as discussed above with respect to Fig. 19.

Fig. 25 is a flowchart of the sub unit. If a packet signal from the main unit is received through some of the optical communication windows 1305a to 1305m in step 2501, a packet signal

corresponding to the optical communication windows through which the signal from the main unit has been received is formed in one of steps 2503 to 2506. Then, in step 2507, the formed packet signal is transmitted to the main unit through the optical communication windows through which the signal from the main unit has been received.

According to the present invention, as described above, the orientation of a picture on a display screen of an input-output integrated type information processor can be changed according to the orientation of the processor in a used state. It is therefore possible for an operator to use the processor with an optimal orientation. It is also possible for the operator to change the display orientation without performing a special operation for changing the display orientation. Thus, the processor is improved in handling.

While the present invention has been described with respect to what presently are considered to be the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, the present invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

An input-output integrated type electronic apparatus is arranged to enable the orientation of a displayed picture to be changed according to the orientation of the apparatus in a used state, whereby the facility with which the apparatus is used is improved. To change the display orientation, the content of a displayed picture is changed on the basis of a detected orientation of the apparatus.

Claims

1. An information processor comprising:
input means for inputting information;
display means including a display screen for displaying information;
a casing for accommodating said input means and said display means;
detection means for detecting orientation of said casing when the processor is being used; and
control means for changing the orientation of a picture displayed on said display screen on the basis of the detection made by said detection means.

2. An information processor according to claim 1, wherein said input means comprises a digitizer.

3. An information processor according to claim 2, wherein said display means is superposed on said digitizer.

4. An information processor according to claim 1, wherein said control means includes means for converting a displayed picture between a longitudinal position and a widthwise position.

5. An information processor according to claim 1, wherein said casing has a member for determining the orientation in which the processor is used.

6. An information processor comprising:
input means for inputting information;
display means for displaying information;
a casing for accommodating said input means and said display means;
detection means for detecting orientation of said casing when the processor is being used; and
control means for changing the orientation of a display content of said display means on the basis of the detection made by said detection means.

7. An information processor according to claim 6, wherein said input means comprises a digitizer.

8. An information processor according to claim 7, wherein said display means is superposed on said digitizer.

9. An information processor according to claim 6, wherein said control means includes means for converting longitudinal and widthwise orientations.

10. An information processor according to claim 6, wherein said casing has a member for determining the orientation in which the processor is used.

11. An information processor comprising:
input means for inputting information;
display means including a display screen for displaying information;
a casing for accommodating said input means and said display means;
a base for receiving said casing;
detection means for detecting orientation of said casing relative to said base; and
control means for changing the orientation of a picture displayed on said display screen on the basis of the detection made by said detection means.

12. An information processor according to claim 11, wherein said input means comprises a digitizer.

13. An information processor according to claim 12, wherein said display means is superposed on said digitizer.

14. An information processor according to claim 11, wherein said control means includes means for converting a displayed picture between a longitudinal position and a widthwise position.

15. An information processor according to claim 11, wherein said casing has a member for determining the orientation in which the processor is used.

16. An input-output integrated type information processor comprising:
input means for inputting information;
display means including a display screen for displaying information
detection means for detecting orientation of the information processor when in use; and
control means for controlling a method of displaying a picture on said display screen;
wherein said control means is controlled on the basis of a result of the detection made by said detection means.

17. An input-output integrated type information processor according to claim 16, further comprising:
a casing for accommodating said input means and said display means;
a base for receiving said casing; and
connection elements for connecting said casing and said base, wherein
said detection means detects the orientation of said display screen from the state of connection of said connection elements.

18. An input-output integrated type information processor according to claim 17, wherein said input means comprises a digitizer.

19. An input-output integrated type information processor according to claim 18, wherein said display means is superposed on said digitizer.

20. An input-output integrated type information processor according to claim 16, wherein said control means includes means for converting a displayed picture between a longitudinal position and a widthwise position.

FIG. 1

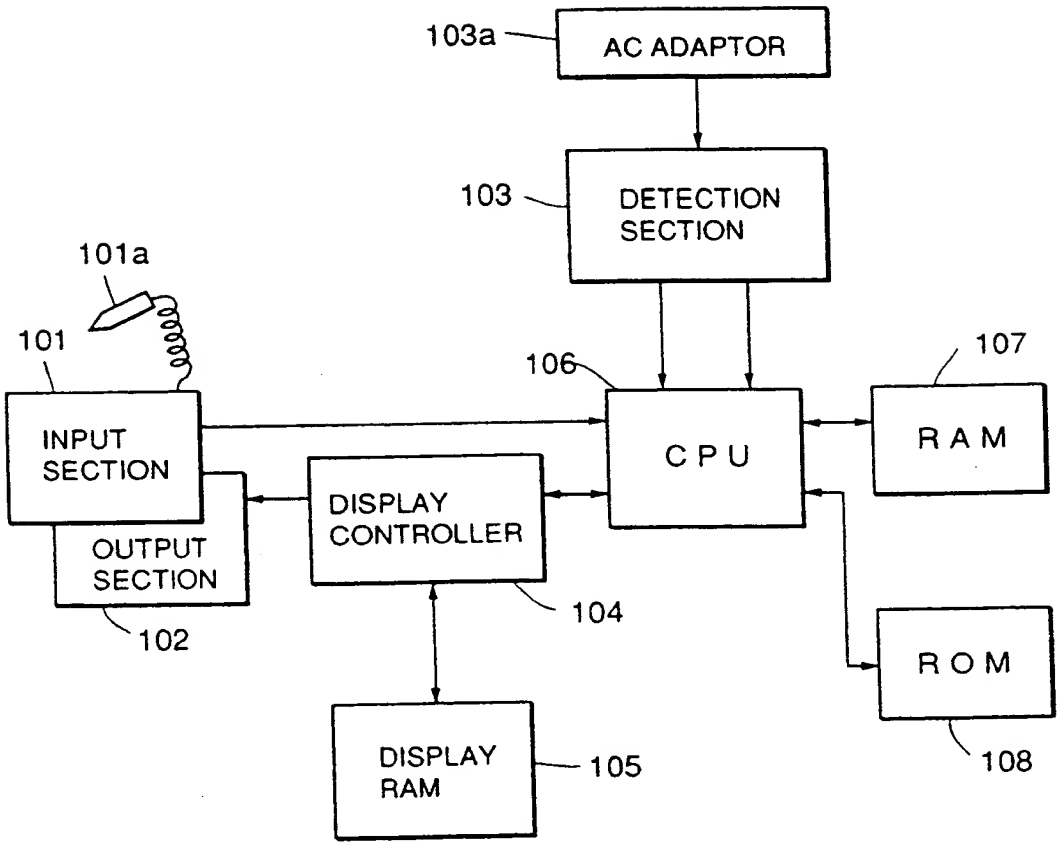

103a
AC ADAPTOR
103
DETECTION SECTION
101a
101
106
107
INPUT SECTION
CPU
RAM
DISPLAY CONTROLLER
OUTPUT SECTION
104
102
ROM
DISPLAY RAM
105
108

FIG. 2

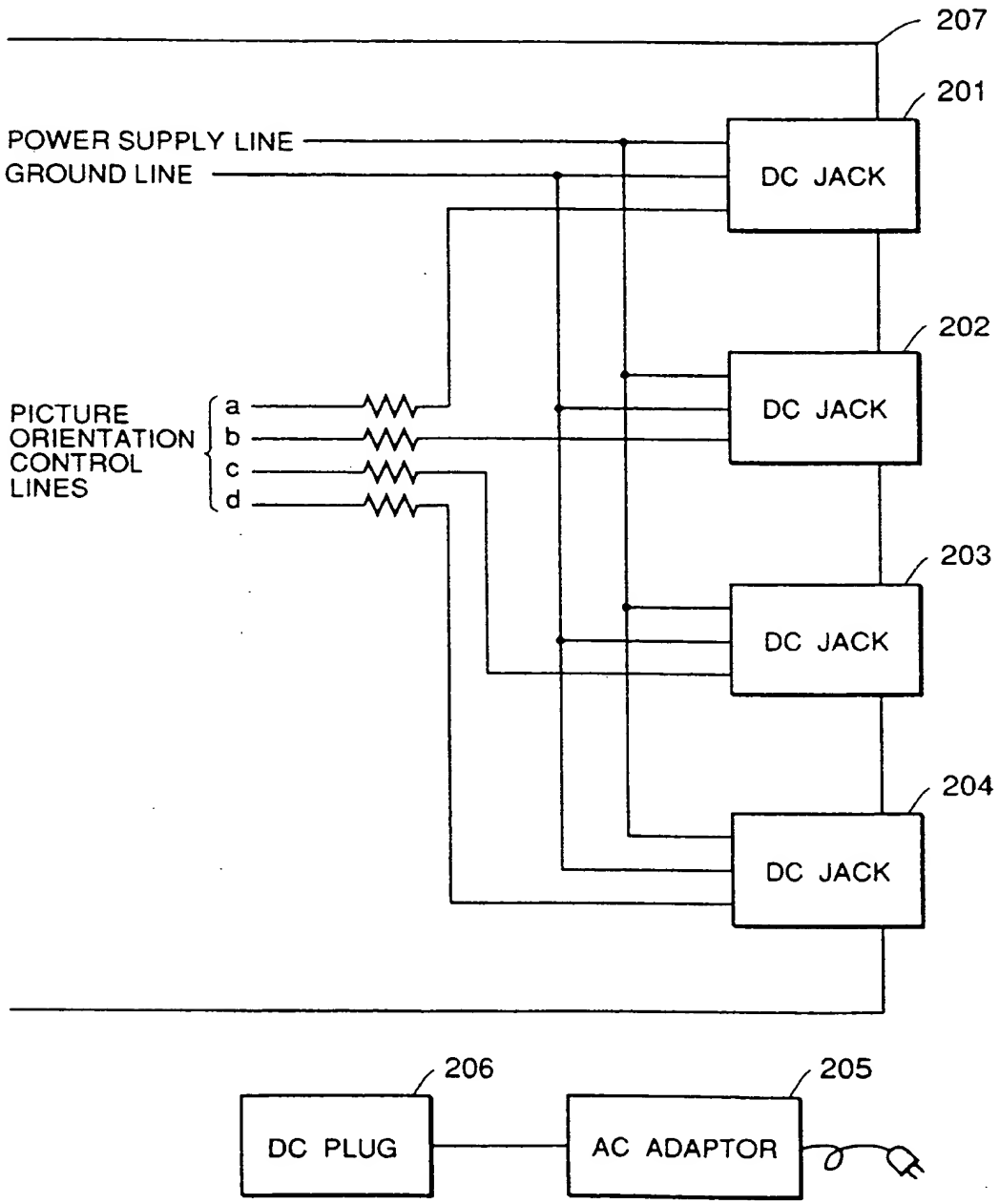

207
201
POWER SUPPLY LINE
GROUND LINE
DC JACK
202
PICTURE ORIENTATION CONTROL LINES
a
b
c
d
DC JACK
203
DC JACK
204
DC JACK
206
205
DC PLUG
AC ADAPTOR

FIG. 3

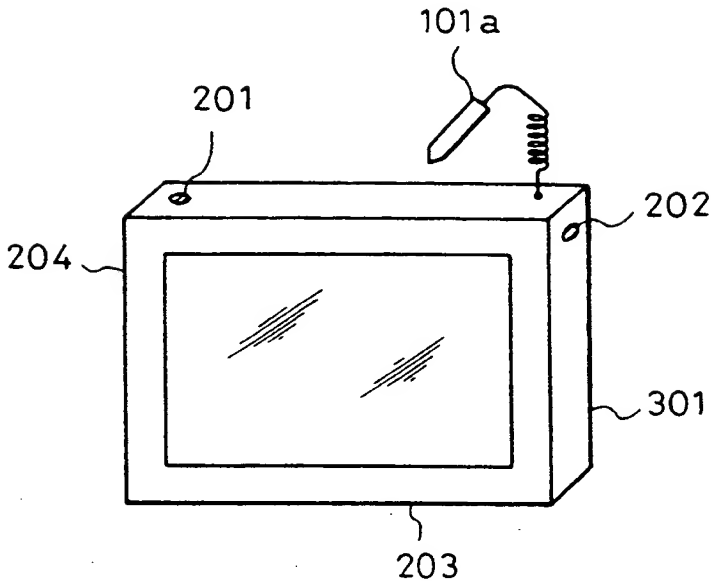


FIG. 4(a)

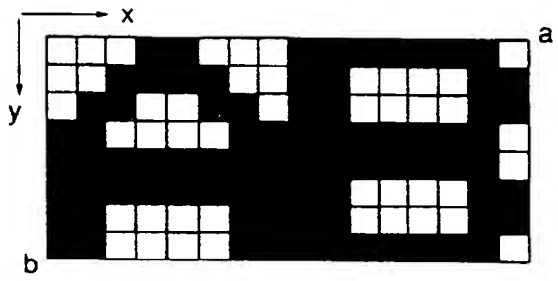


FIG. 4(b)

ADDRESS	bit 7							bit 0	bit 7							bit 0	ADDRESS
00h	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	0	01h
02h	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	1	03h
04h	0	1	1	0	0	1	1	0	1	1	0	0	0	0	1	1	05h
06h	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	07h
08h	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	09h
0ah	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0bh
0ch	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	0dh
0eh	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0fh

FIG. 4(c)

ADDRESS	bit 7							bit 0	bit 7							bit 0	ADDRESS
00h	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	01h
02h	0	0	0	0	1	1	1	1	0	0	1	1	1	1	0	0	03h
04h	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	05h
06h	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	07h
08h	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	09h
0ah	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	0bh
0ch	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	0dh
0eh	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0fh

FIG. 4(d)

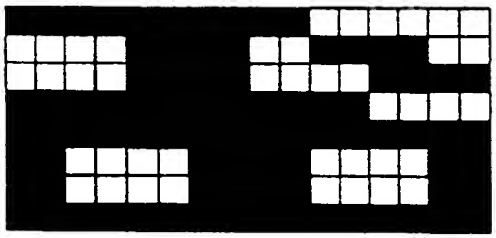


FIG. 4(e)

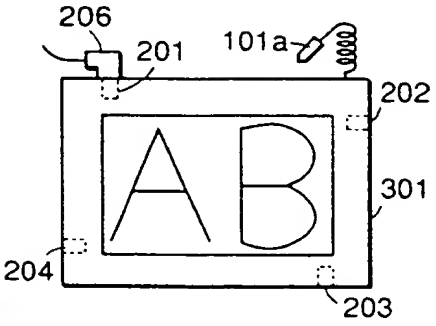


FIG. 4(f)

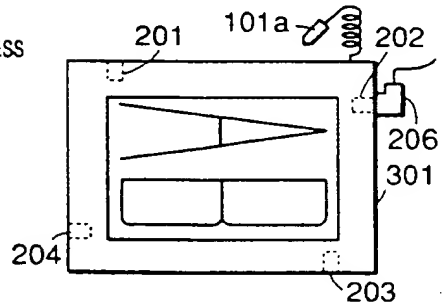


FIG. 4(g)

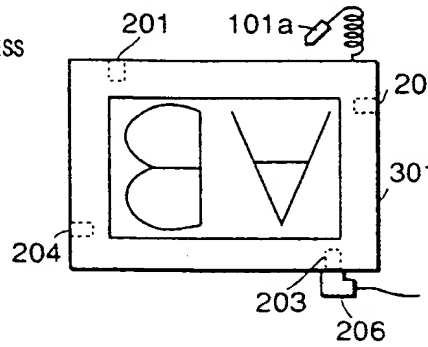


FIG. 4(h)

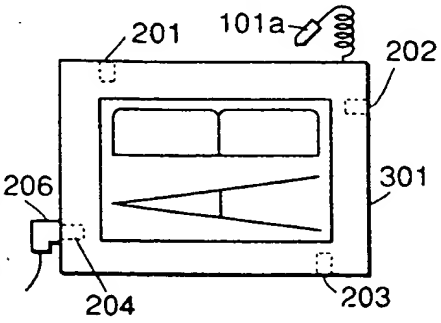


FIG. 5

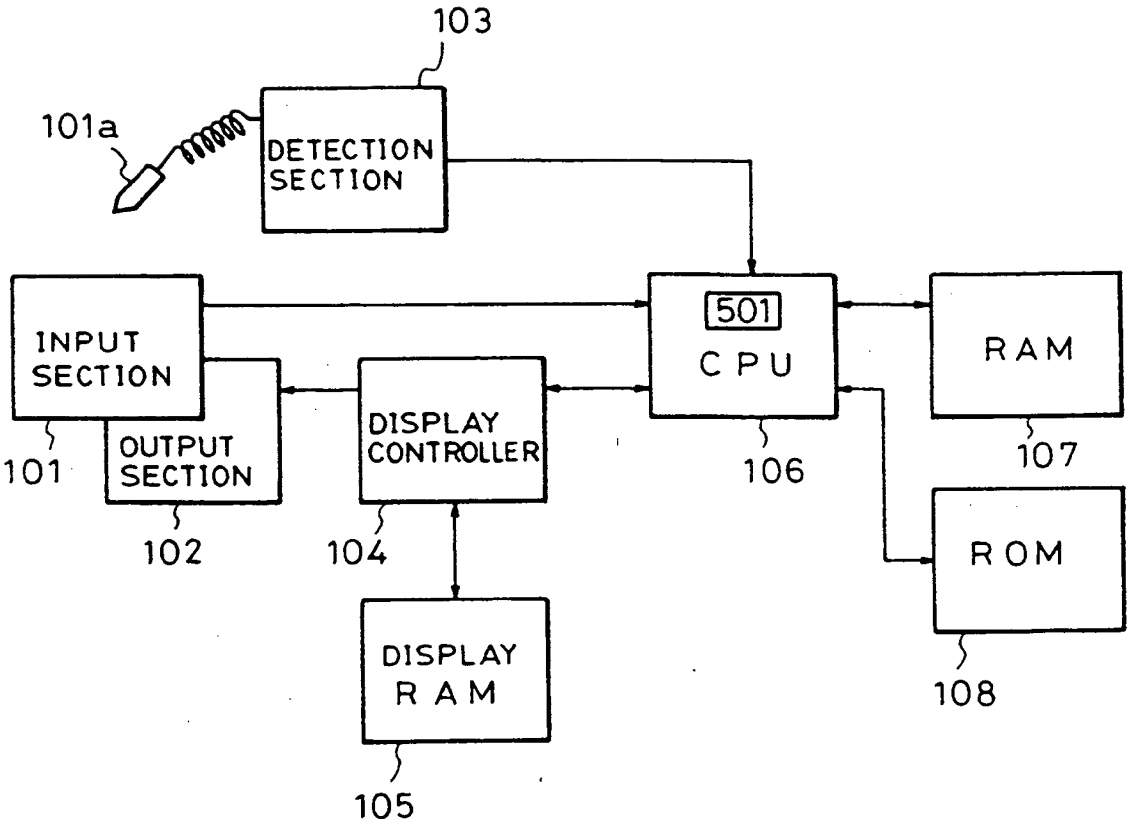

103
101a
DETECTION SECTION
INPUT SECTION
OUTPUT SECTION
101
102
DISPLAY CONTROLLER
104
DISPLAY RAM
105
501
CPU
106
RAM
107
ROM
108

FIG. 6

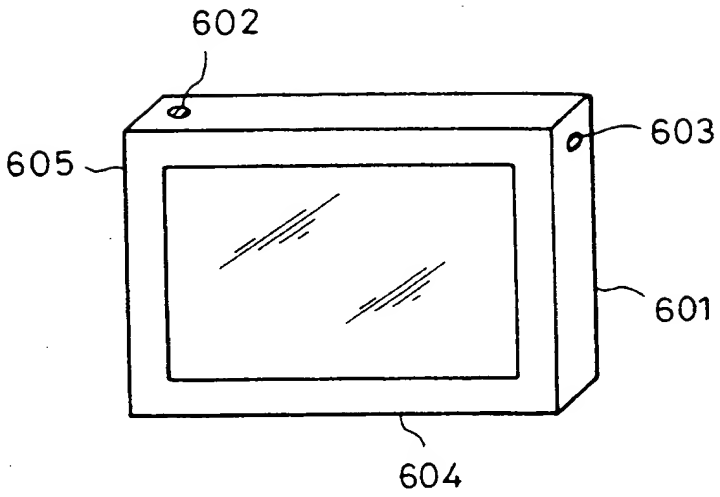


FIG. 7

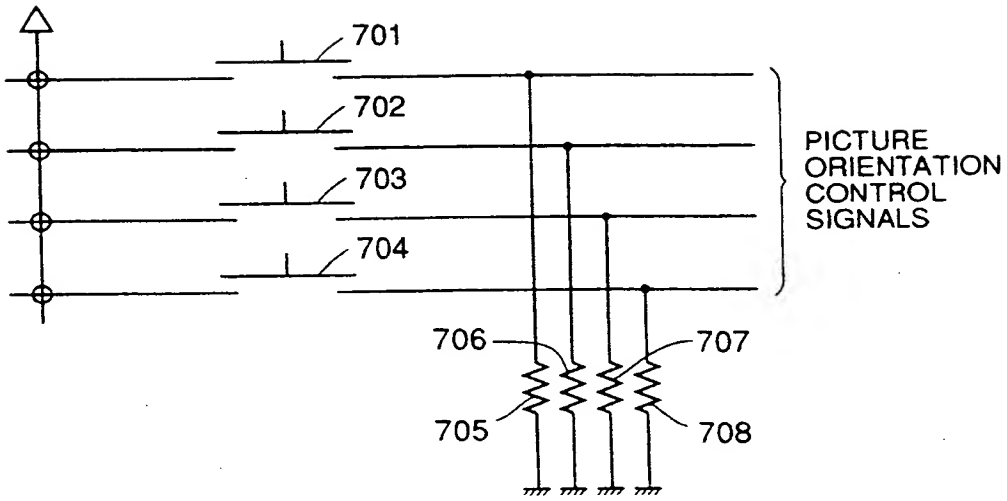

701
702
703
704
PICTURE
ORIENTATION
CONTROL
SIGNALS
706
707
705
708

FIG. 8

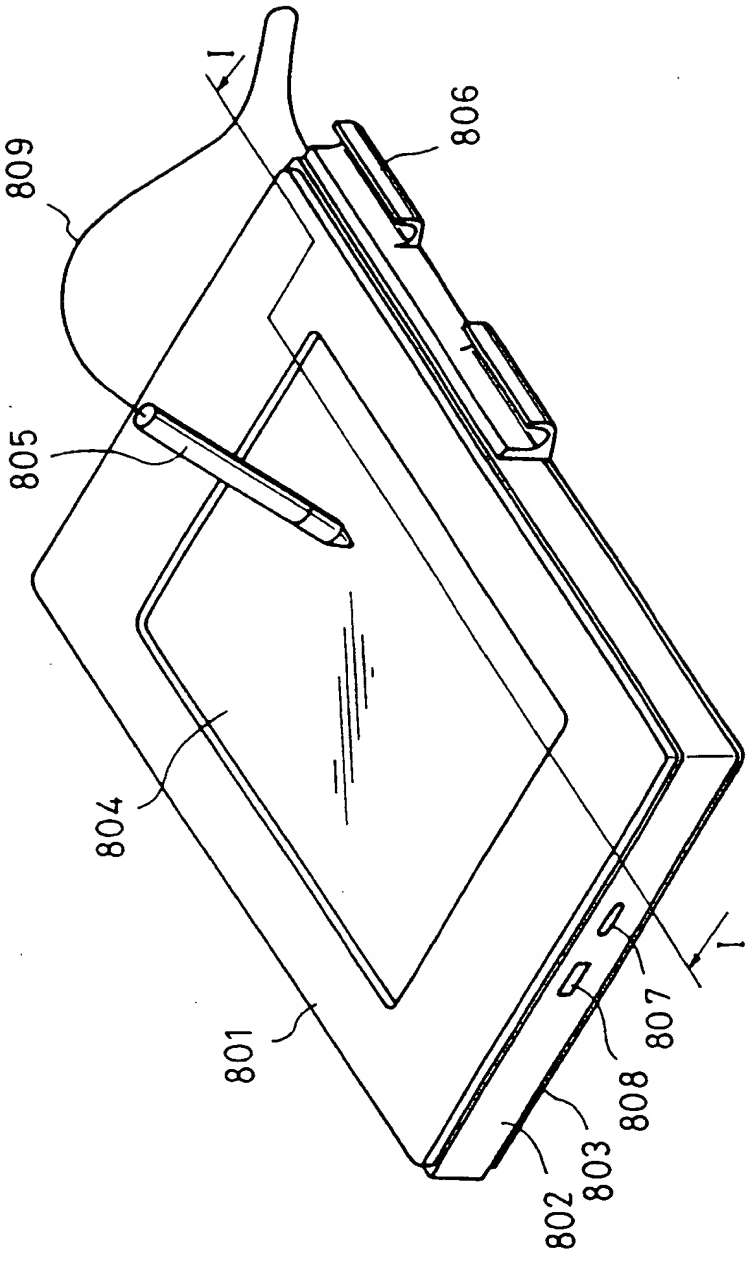


FIG. 9

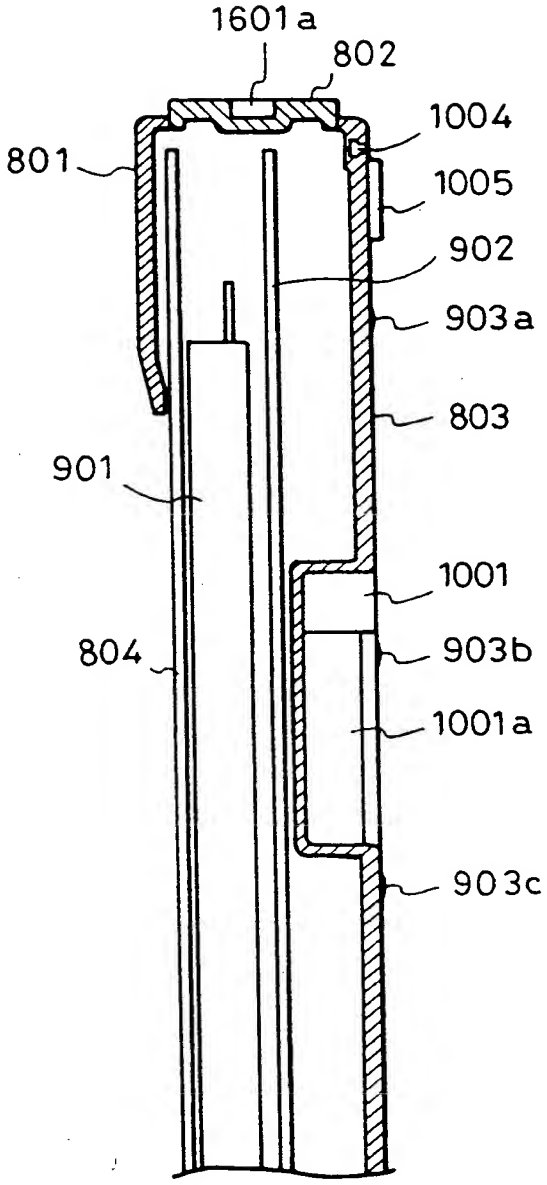

1601a
802
1004
801
1005
902
903a
803
901
1001
804
903b
1001a
903c

FIG. 10

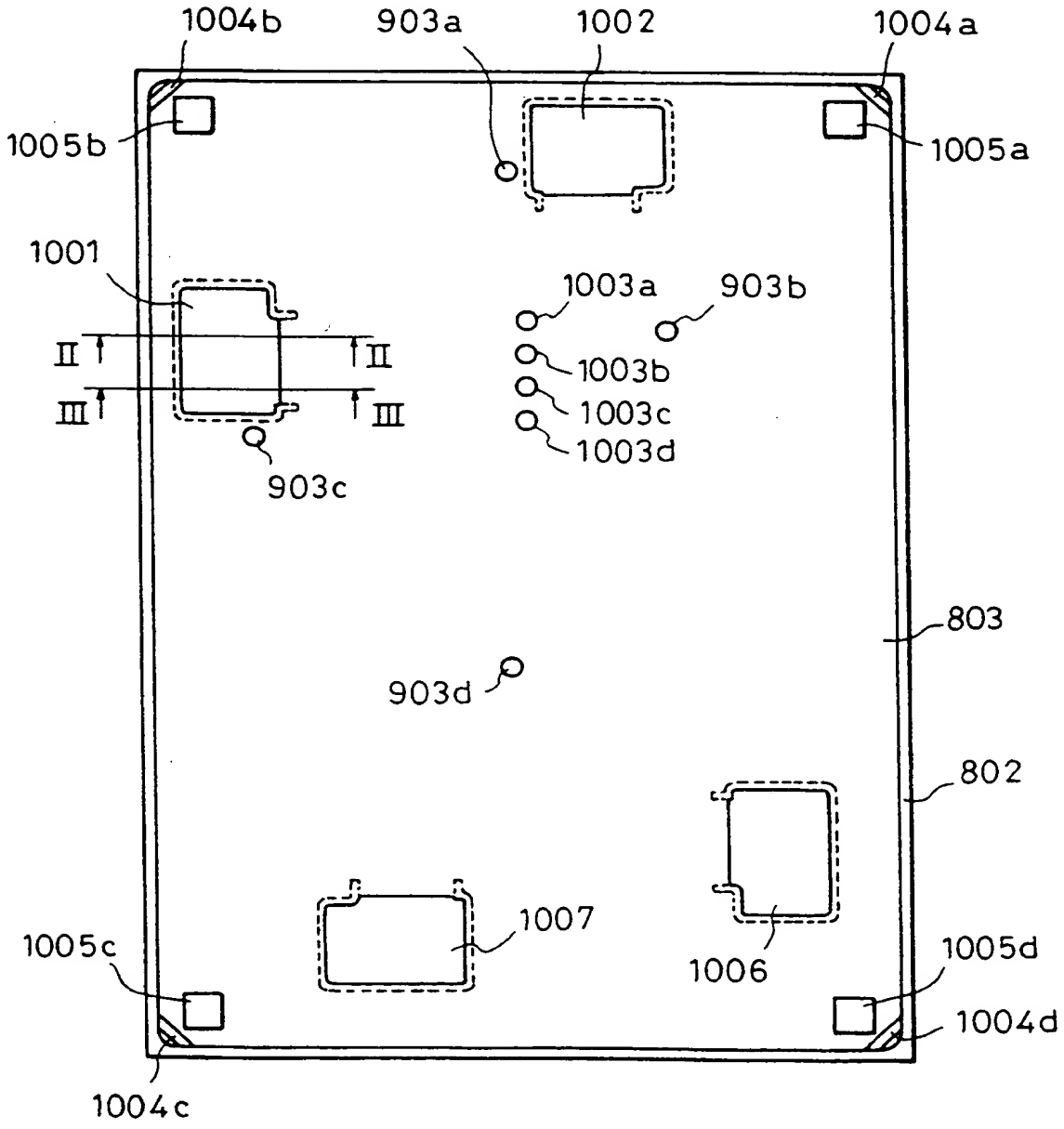

1004b
903a
1002
1004a
1005b
1005a
1001
1003a
903b
II
II
1003b
III
III
1003c
1003d
903c
803
903d
802
1007
1005c
1006
1005d
1004d
1004c

FIG. 11

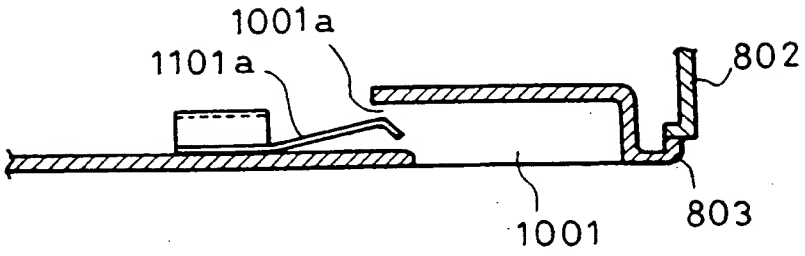


FIG. 12

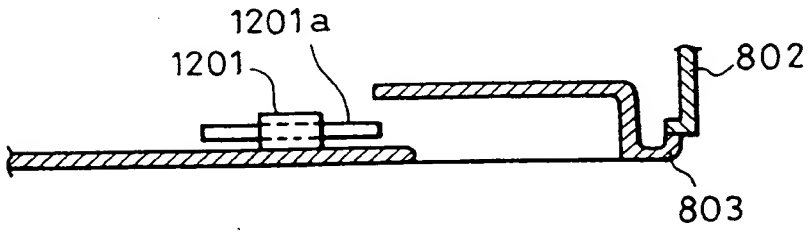


FIG. 13

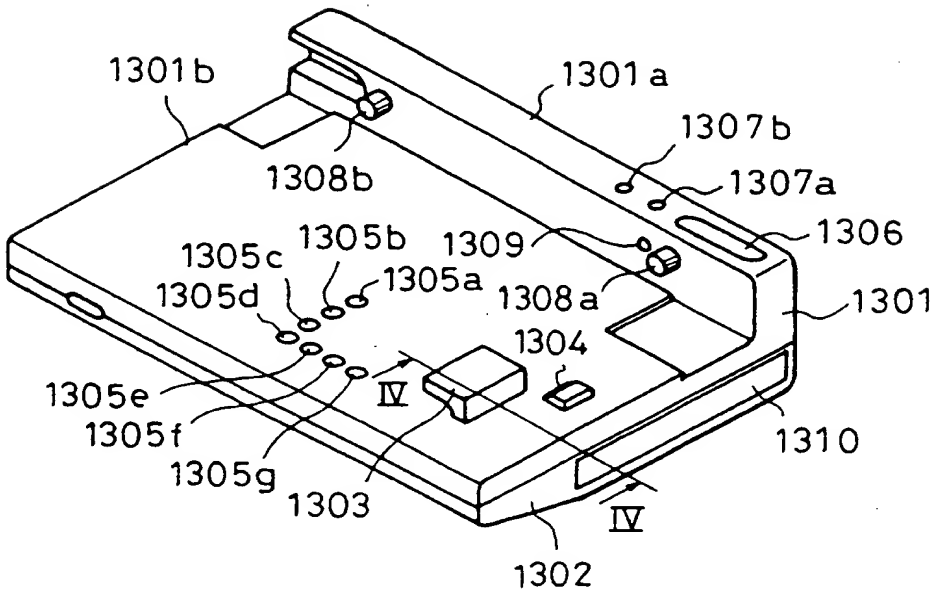

1301b
1301a
1307b
1308b
1307a
1306
1305c
1305b
1309
1305d
1305a
1308a
1301
1304
1305e
IV
1305f
1310
1305g
1303
IV
1302

FIG. 14

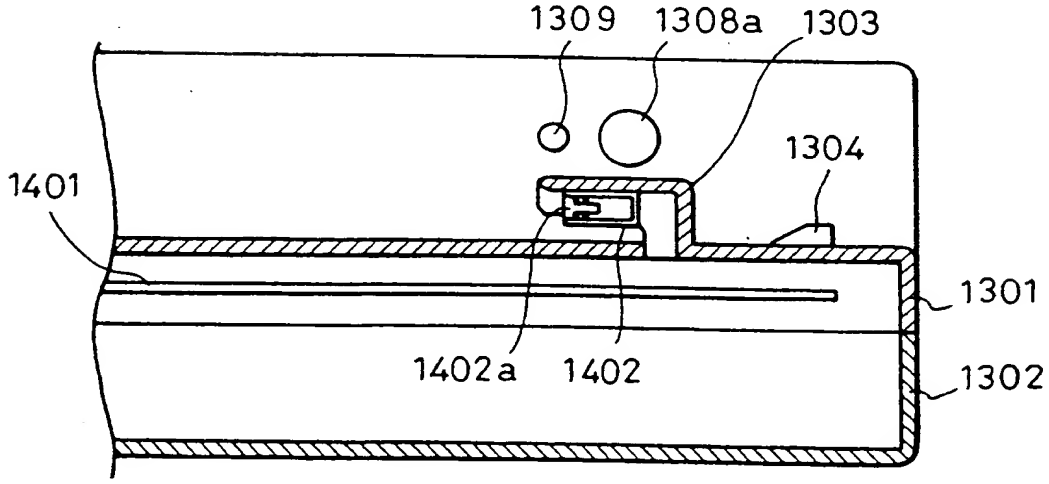

1309
1308a
1303
1304
1401
1301
1402a
1402
1302

FIG. 15(a)

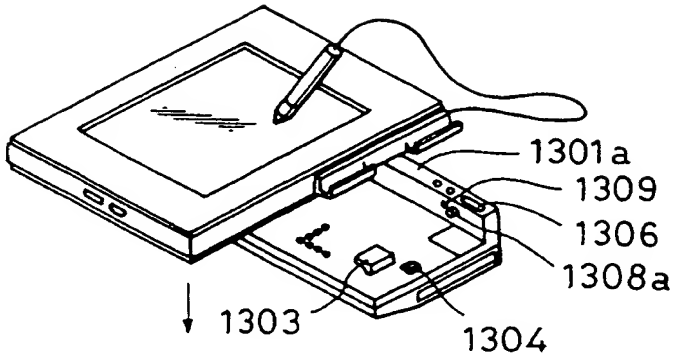


FIG. 15(b)

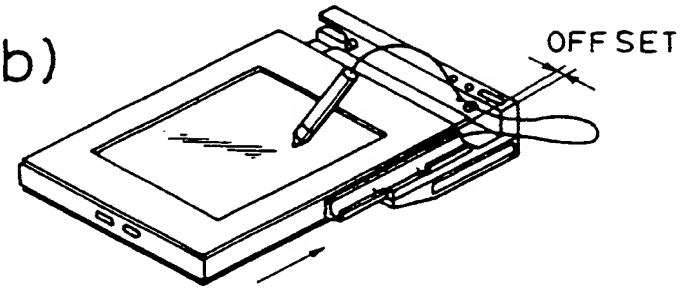


FIG. 15(c)

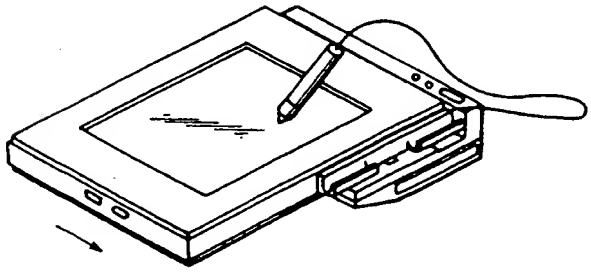


FIG. 15(d)

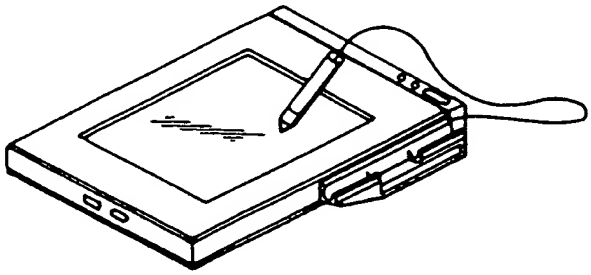


FIG. 16

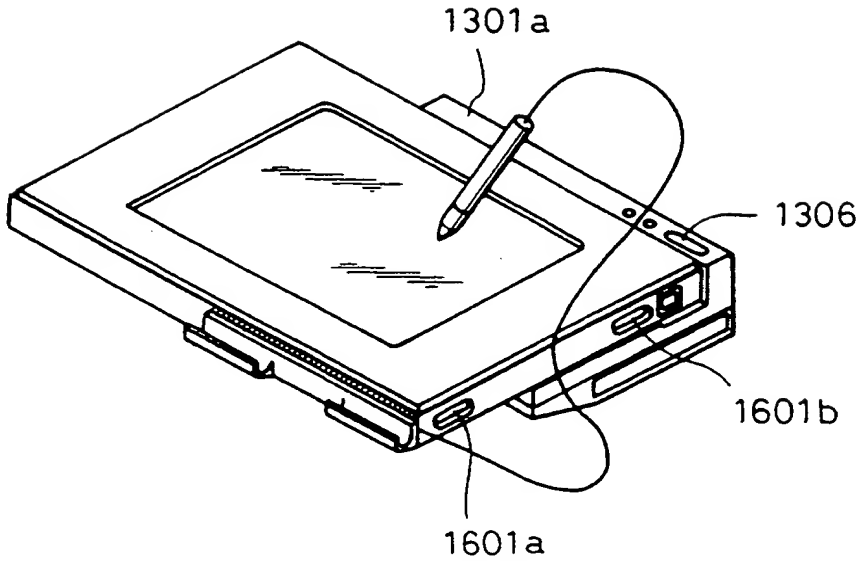


FIG. 17

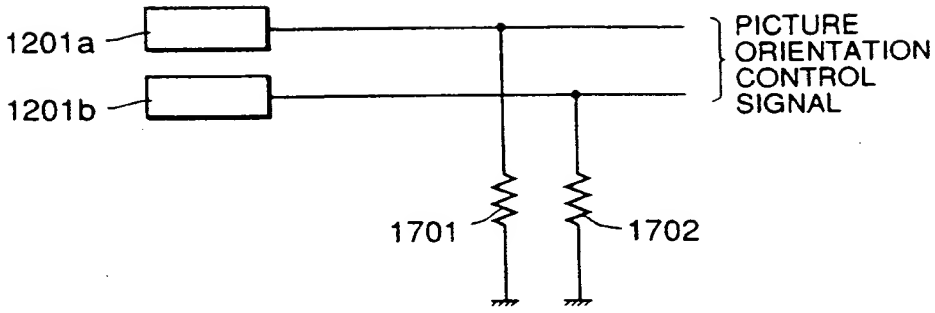


FIG. 18
PRIOR ART

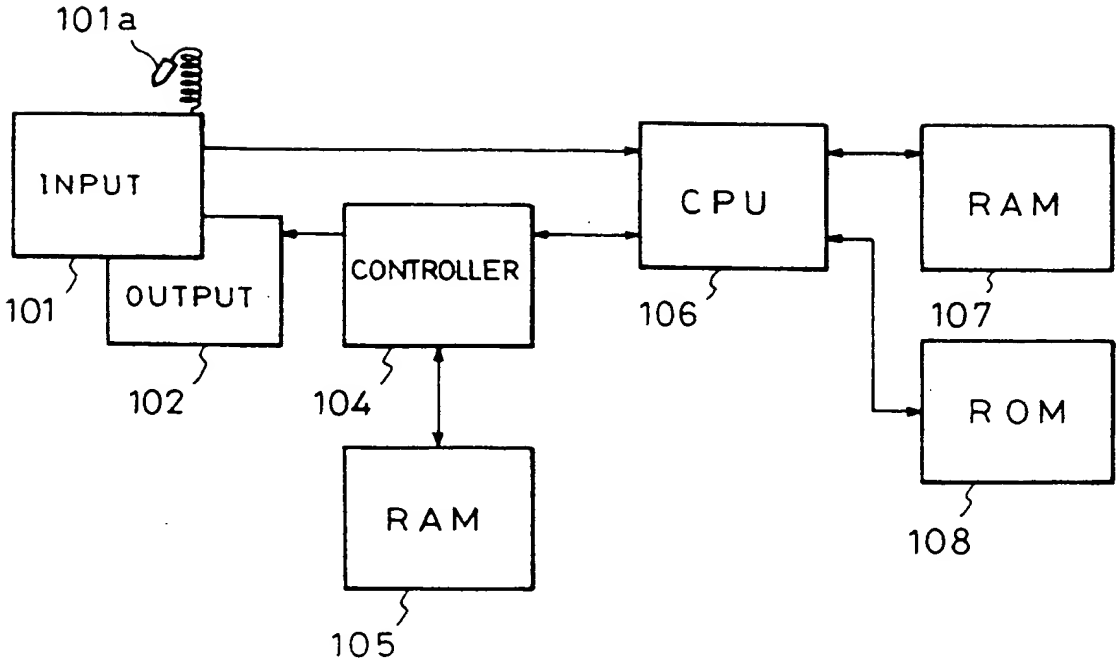


FIG. 19

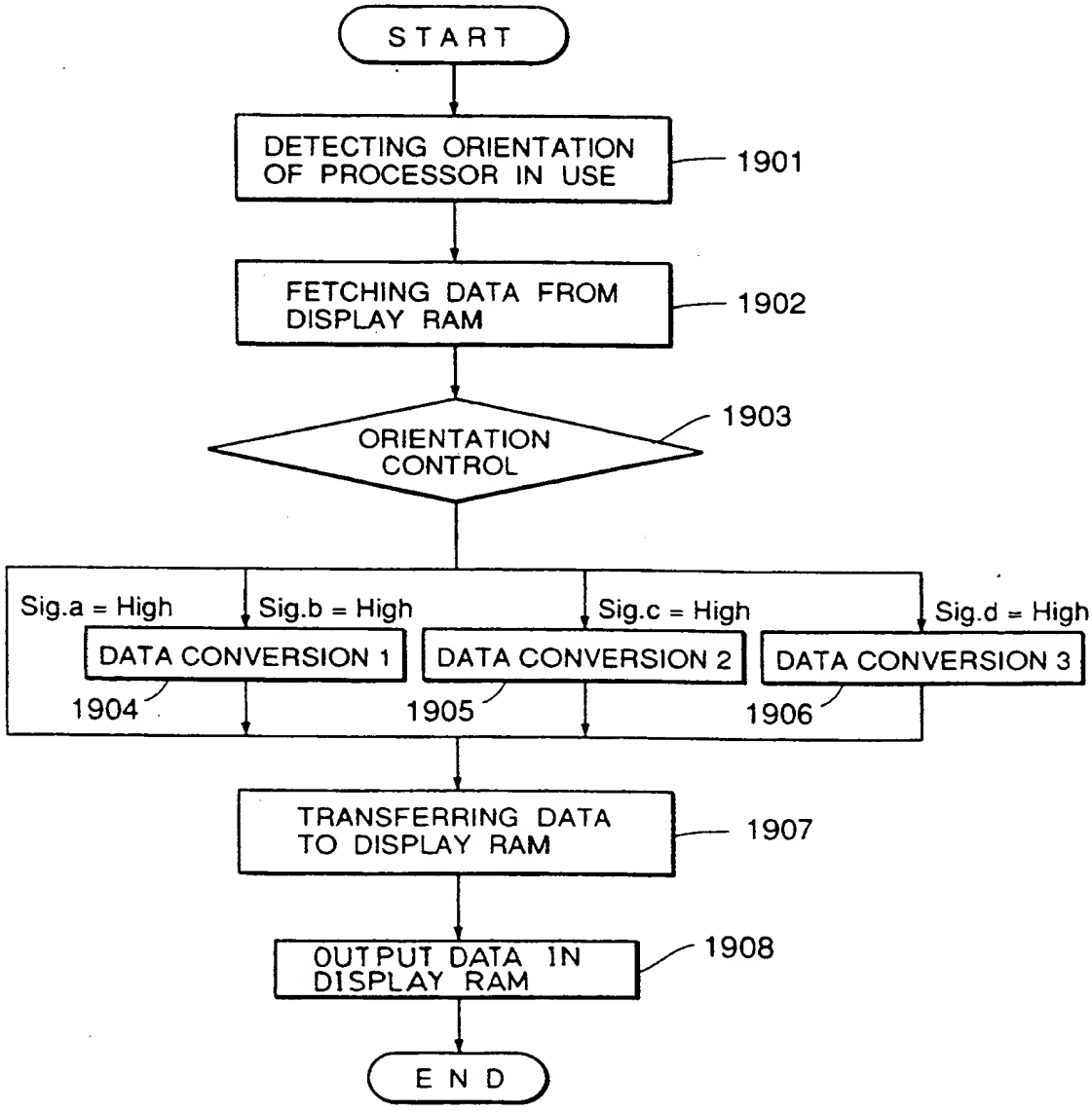

START
DETECTING ORIENTATION OF PROCESSOR IN USE
1901
FETCHING DATA FROM DISPLAY RAM
1902
ORIENTATION CONTROL
1903
Sig.a = High
Sig.b = High
Sig.c = High
Sig.d = High
DATA CONVERSION 1
DATA CONVERSION 2
DATA CONVERSION 3
1904
1905
1906
TRANSFERRING DATA TO DISPLAY RAM
1907
OUTPUT DATA IN DISPLAY RAM
1908
E N D

FIG. 20

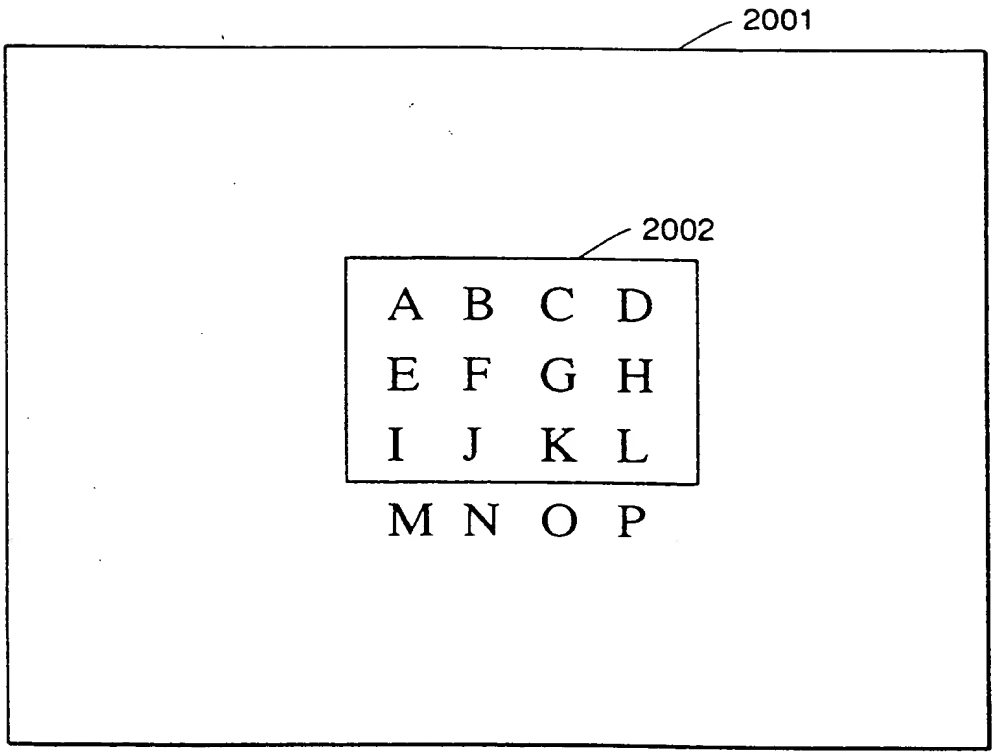


FIG. 21 (a)

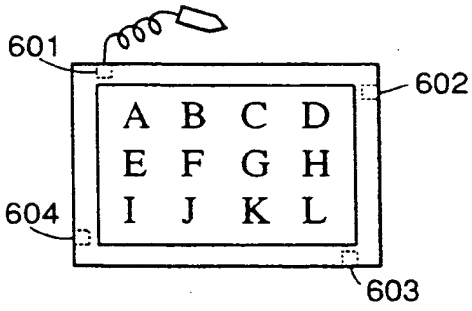


FIG. 21 (b)

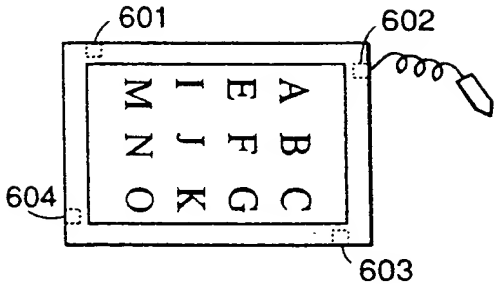


FIG. 21 (c)

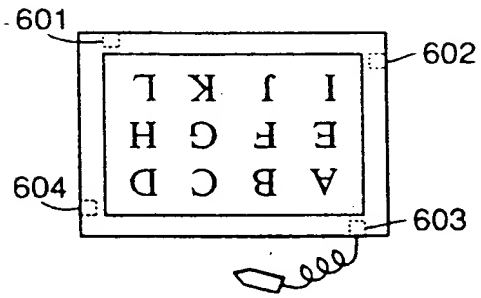


FIG. 21 (d)

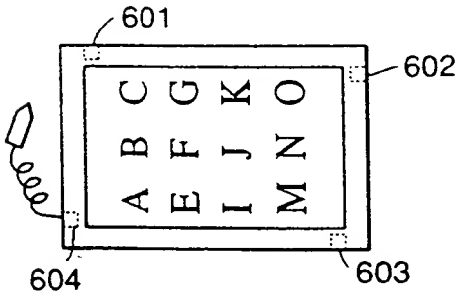


FIG. 22

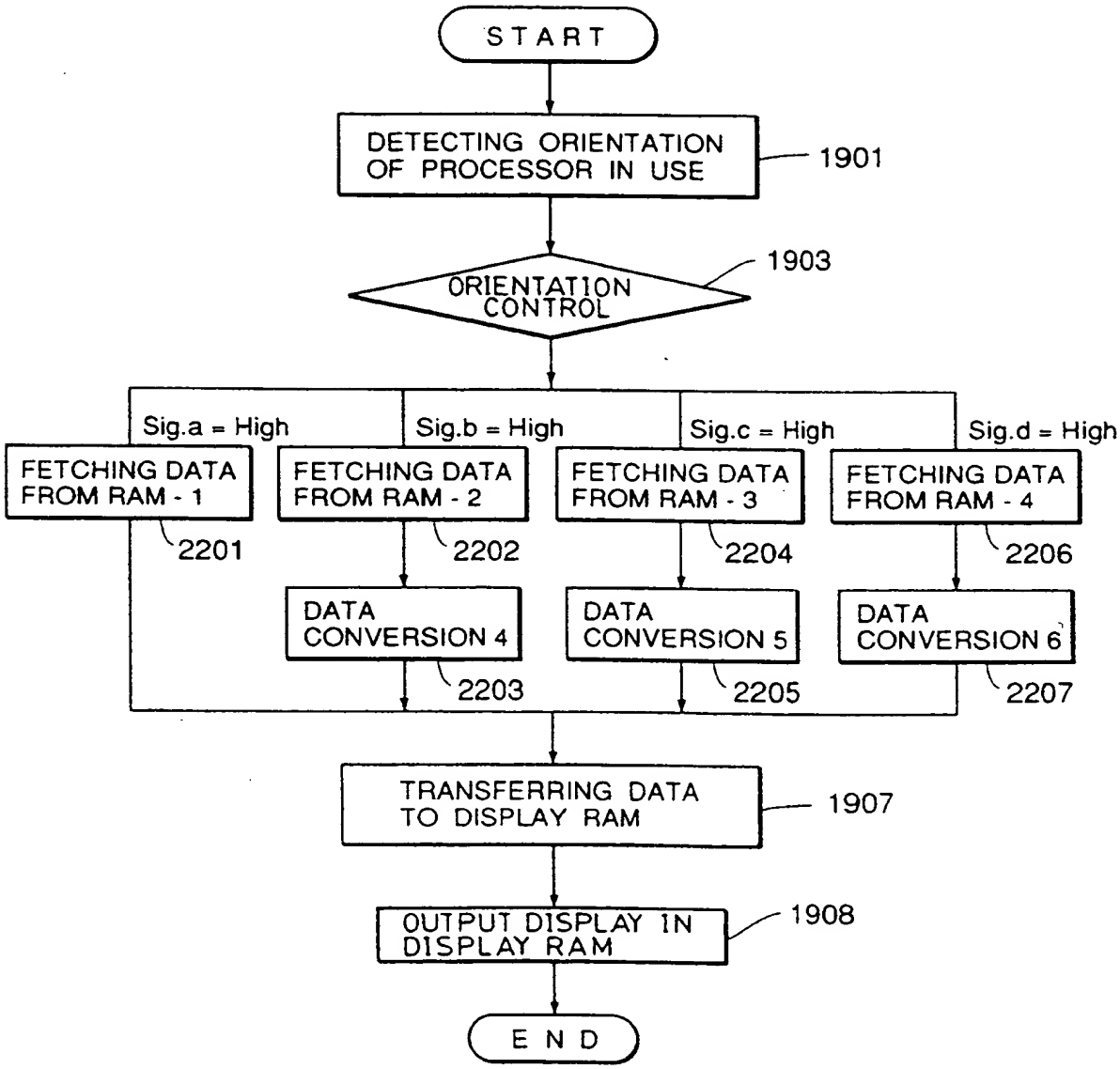

START
DETECTING ORIENTATION OF PROCESSOR IN USE
1901
ORIENTATION CONTROL
1903
Sig.a = High
Sig.b = High
Sig.c = High
Sig.d = High
FETCHING DATA FROM RAM - 1
FETCHING DATA FROM RAM - 2
FETCHING DATA FROM RAM - 3
FETCHING DATA FROM RAM - 4
2201
2202
2204
2206
DATA CONVERSION 4
DATA CONVERSION 5
DATA CONVERSION 6
2203
2205
2207
TRANSFERRING DATA TO DISPLAY RAM
1907
OUTPUT DISPLAY IN DISPLAY RAM
1908
END

FIG. 23

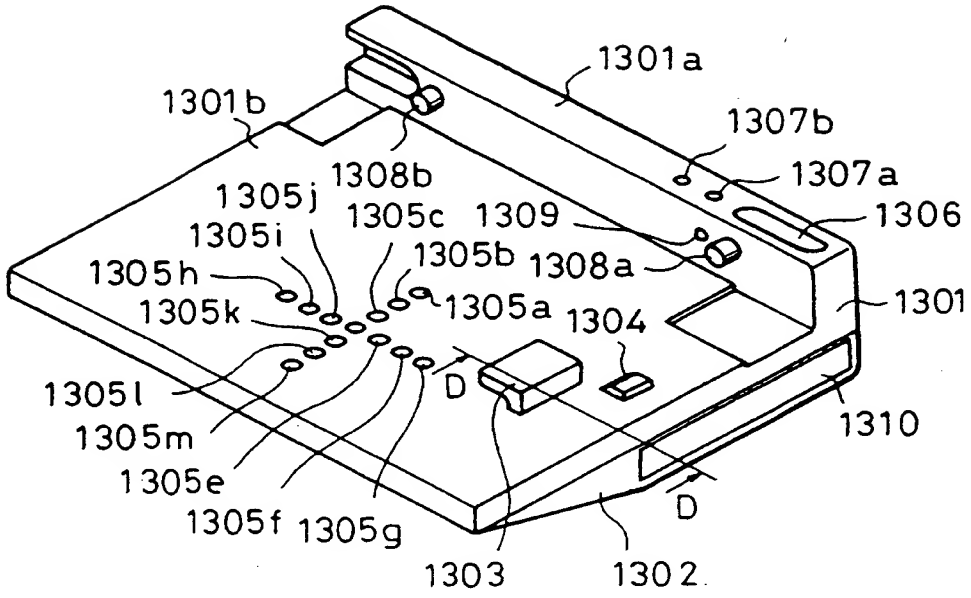

1301a
1301b
1307b
1307a
1308b
1305j
1305c
1309
1306
1305i
1305b
1308a
1305h
1305a
1304
1301
1305k
D
13051
1310
1305m
1305e
1305f
1305g
D
1303
1302

FIG. 24

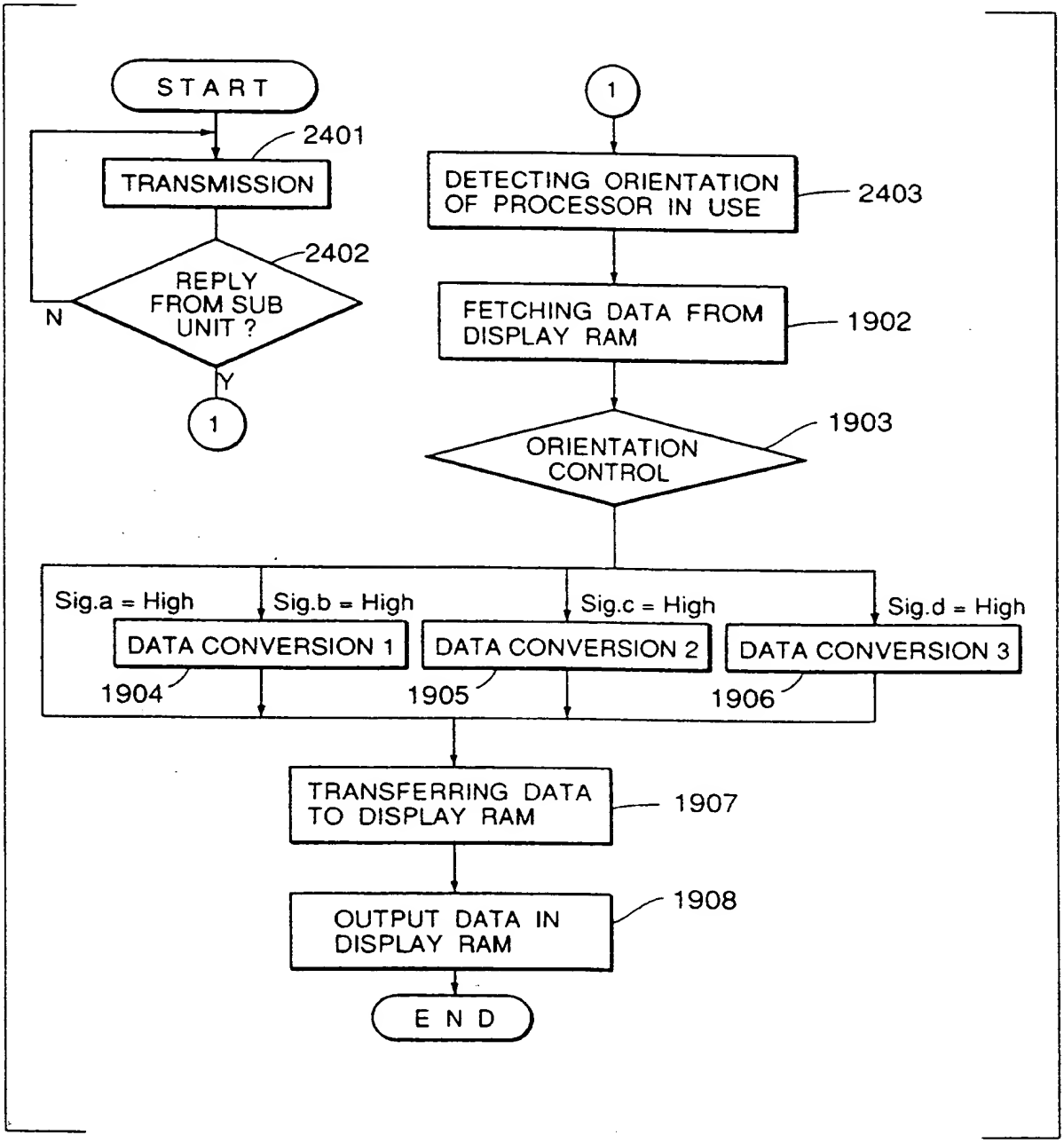

START
2401
TRANSMISSION
2402
REPLY FROM SUB UNIT ?
N
Y
1
1
DETECTING ORIENTATION OF PROCESSOR IN USE
2403
FETCHING DATA FROM DISPLAY RAM
1902
ORIENTATION CONTROL
1903
Sig.a = High
Sig.b = High
Sig.c = High
Sig.d = High
DATA CONVERSION 1
DATA CONVERSION 2
DATA CONVERSION 3
1904
1905
1906
TRANSFERRING DATA TO DISPLAY RAM
1907
OUTPUT DATA IN DISPLAY RAM
1908
E N D

FIG. 25

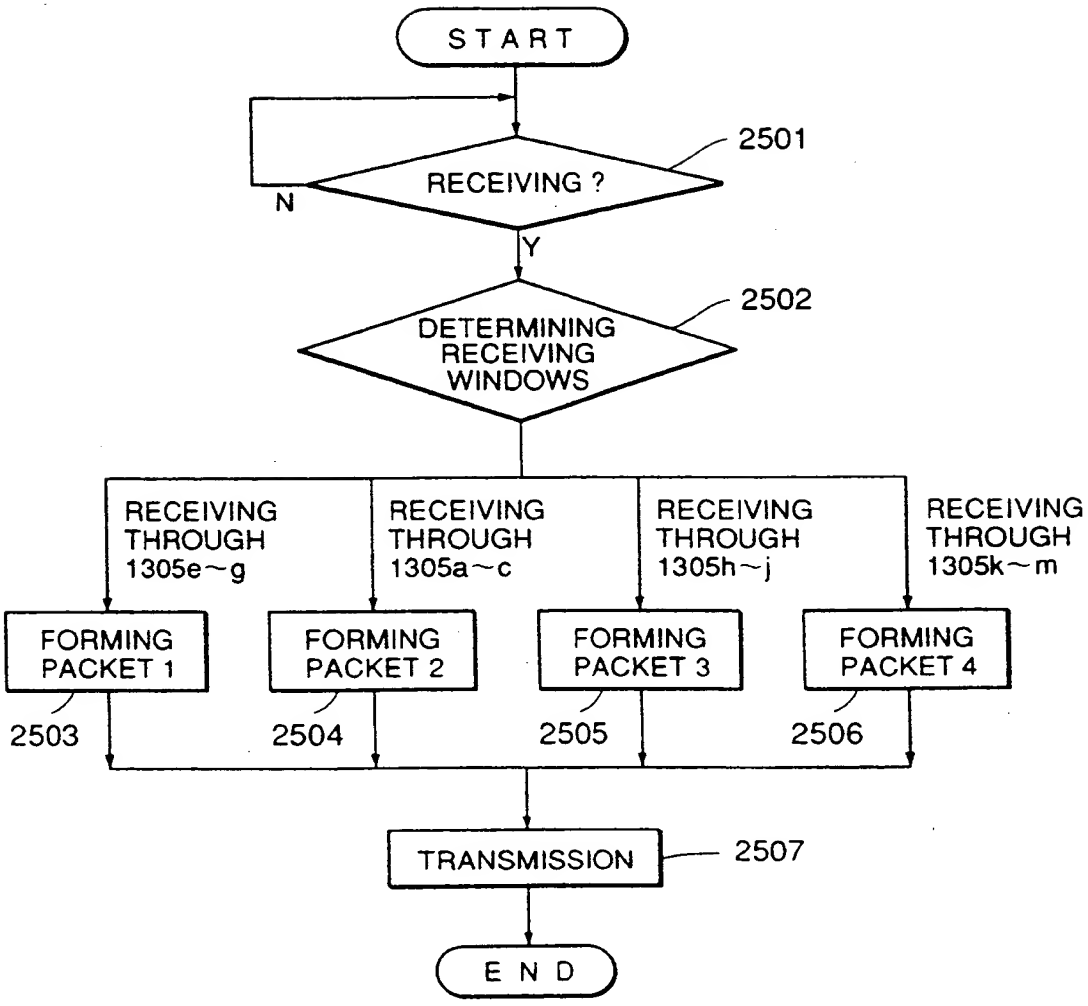

START
RECEIVING ?
2501
N
Y
DETERMINING RECEIVING WINDOWS
2502
RECEIVING THROUGH 1305e~g
RECEIVING THROUGH 1305a~c
RECEIVING THROUGH 1305h~j
RECEIVING THROUGH 1305k~m
FORMING PACKET 1
FORMING PACKET 2
FORMING PACKET 3
FORMING PACKET 4
2503
2504
2505
2506
TRANSMISSION
2507
END

FIG. 26

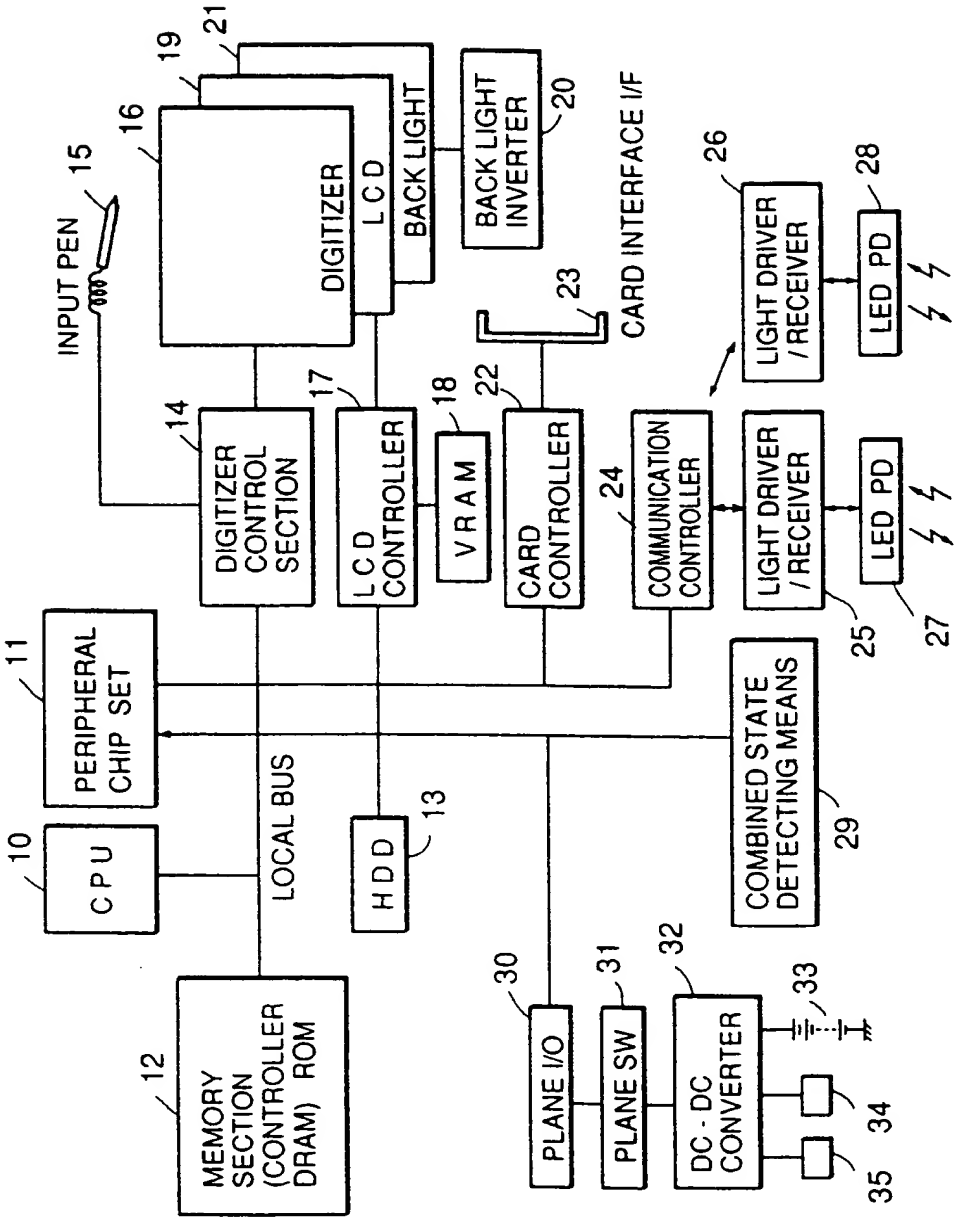

INPUT PEN
15
16
19
21
DIGITIZER
LCD
BACK LIGHT
BACK LIGHT INVERTER
20
CARD INTERFACE I/F
23
26
LIGHT DRIVER / RECEIVER
28
LED PD
14
DIGITIZER CONTROL SECTION
17
LCD CONTROLLER
18
VRAM
22
CARD CONTROLLER
24
COMMUNICATION CONTROLLER
LIGHT DRIVER / RECEIVER
25
LED PD
27
11
PERIPHERAL CHIP SET
10
CPU
LOCAL BUS
HDD
13
COMBINED STATE DETECTING MEANS
29
12
MEMORY SECTION (CONTROLLER DRAM) ROM
30
PLANE I/O
31
PLANE SW
32
DC - DC CONVERTER
33
34
35

FIG. 27(a)

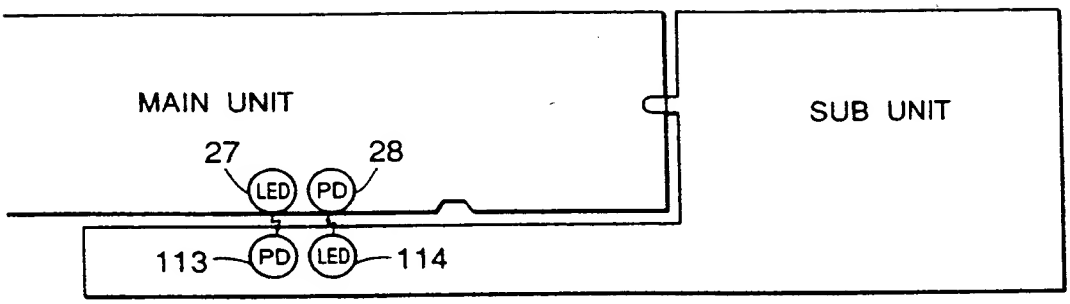


FIG. 27(b)

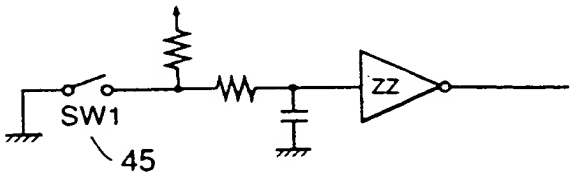


FIG. 28

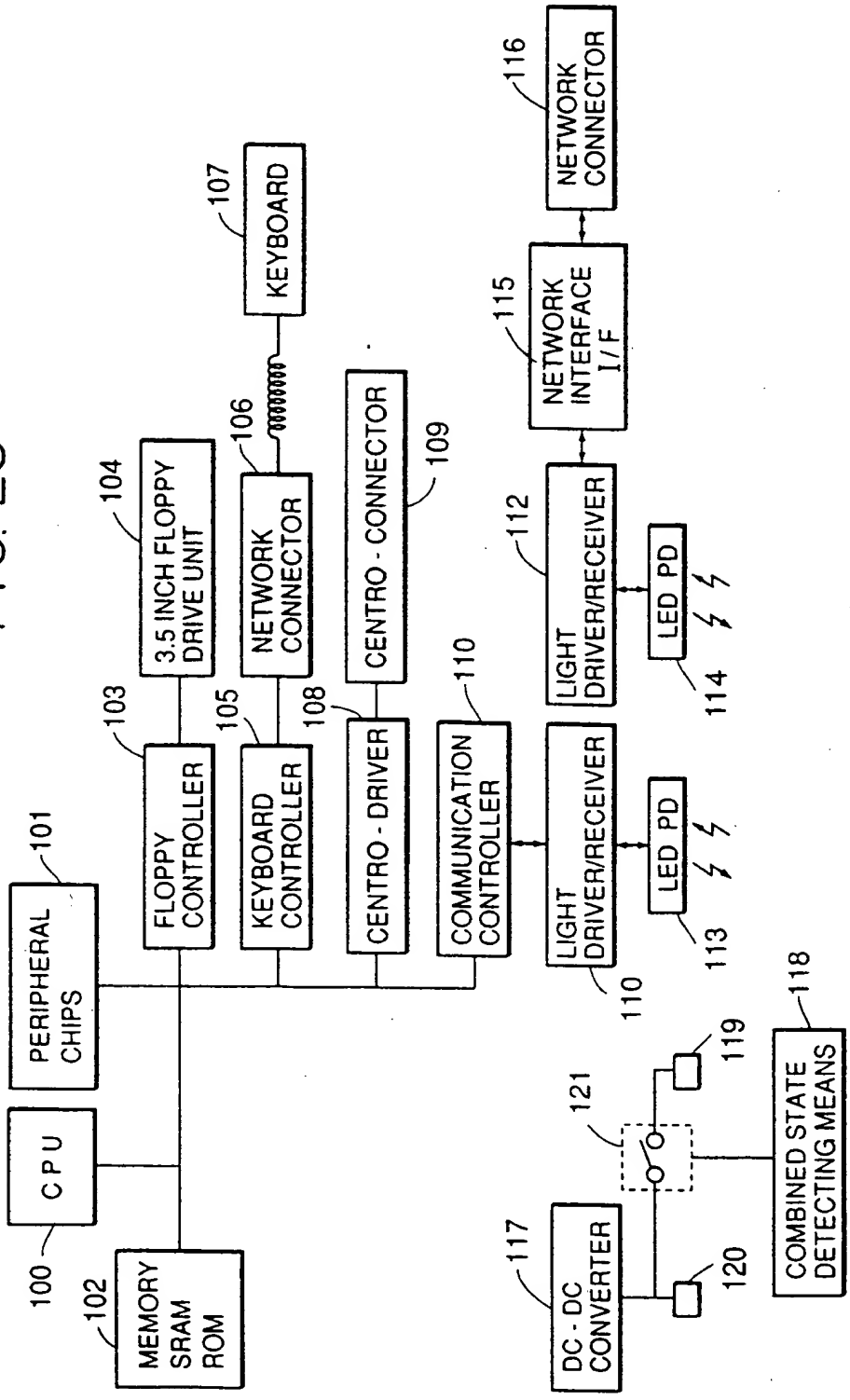
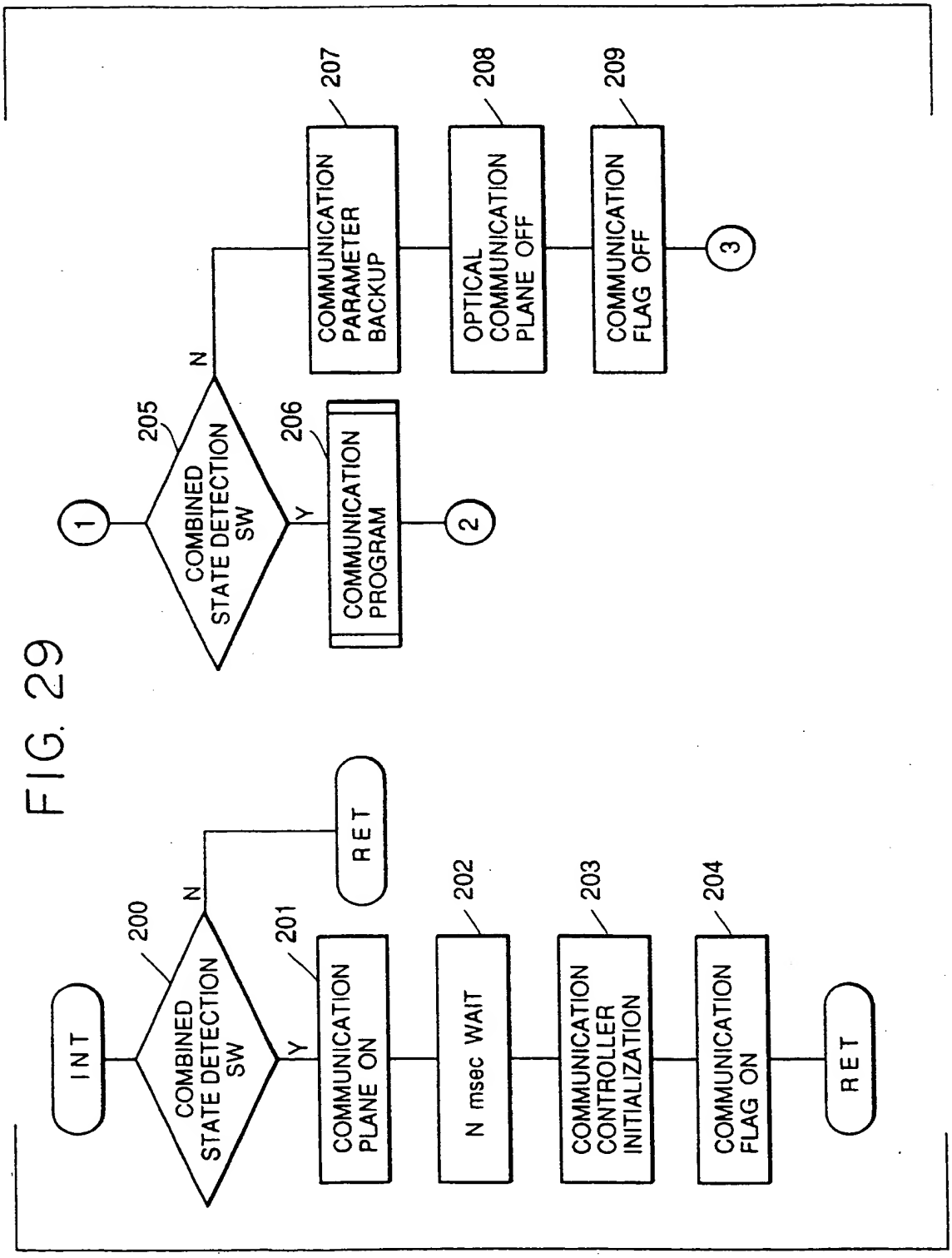

CPU
100
PERIPHERAL CHIPS
101
MEMORY SRAM ROM
102
FLOPPY CONTROLLER
103
3.5 INCH FLOPPY DRIVE UNIT
104
KEYBOARD CONTROLLER
105
NETWORK CONNECTOR
106
KEYBOARD
107
CENTRO - DRIVER
108
CENTRO - CONNECTOR
109
COMMUNICATION CONTROLLER
110
LIGHT DRIVER/RECEIVER
110
LED PD
113
LIGHT DRIVER/RECEIVER
112
LED PD
114
NETWORK INTERFACE I/F
115
NETWORK CONNECTOR
116
DC - DC CONVERTER
117
COMBINED STATE DETECTING MEANS
118
119
120
121

FIG. 29


INT
200
COMBINED STATE DETECTION SW
N
RET
Y
201
COMMUNICATION PLANE ON
202
N msec WAIT
203
COMMUNICATION CONTROLLER INITIALIZATION
204
COMMUNICATION FLAG ON
RET
1
205
COMBINED STATE DETECTION SW
N
206
COMMUNICATION PROGRAM
Y
2
207
COMMUNICATION PARAMETER BACKUP
208
OPTICAL COMMUNICATION PLANE OFF
209
COMMUNICATION FLAG OFF
3

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Tokyo (JP)
Inventor: **Sunakawa, Shinichi**
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Tokyo (JP)

(74) Representative: **Tiedtke, Harro, Dipl.-Ing.**
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(54) Apparatus for controlling image display.

(57) An input-output integrated type electronic apparatus is arranged to enable the orientation of a displayed picture to be changed according to the orientation of the apparatus in a used state, whereby the facility with which the apparatus is used is improved. To change the display orientation, the content of a displayed picture is changed on the basis of a detected orientation of the apparatus.

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FIG. 4 (a)

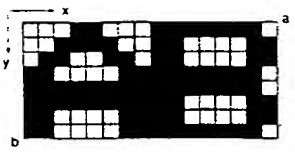


FIG. 4 (e)

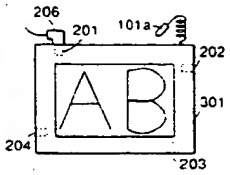


FIG. 4 (b)

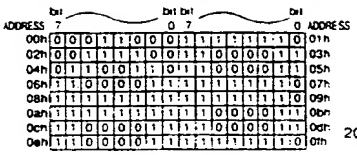


FIG. 4 (f)

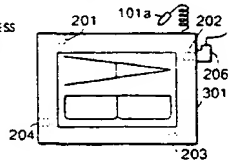


FIG. 4 (c)

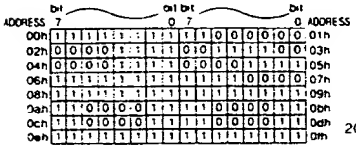


FIG. 4 (g)

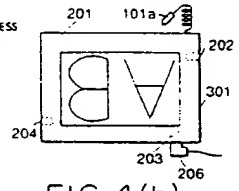


FIG. 4 (d)

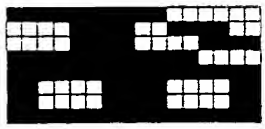
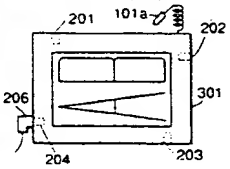


FIG. 4 (h)



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 4498

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	EP-A-0 458 316 (TOSHIBA) * column 1, line 55 - column 4, line 38 * * column 6, line 22 - line 57 *	1-16	G06F3/023 G06F1/16
A	WO-A-91 07716 (ACTIVE BOOK COMPANY) * figures 8,9 *	11,17	
P,A	RESEARCH DISCLOSURE NO 34788 March 1993 , HAVANT GB page 217 XP359926 'Image Orientation Sensing and Correction for Notepads'	1-16	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 March 1995	Bailas, A

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X : particularly relevant if taken alone
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